MOTOROLA

MTP700
Digital Portable Radio
380 - 430 MHz
806 - 870 MHz

Detailed Service Manual

Part Number: 6866534D39-D

October, 2003

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DOCUMENT HISTORY

The following major changes have been implemented in this manual since the previous edition:

Edition	Description	Date
6866534D39-O	Initial edition	Nov. 2001
6866534D39-A	Updated Safety Information to latest version.	Aug. 2002
	Chapter 4.1 and 4.2: Updated Theory of Operation, block diagrams and troubleshooting charts. Changed board diagrams, schematics and parts lists for UHF and 800MHz bands.	
	Chapter 5. Programming: Updated icons for LCD display and edited LCD Display test.	
	Chapter 8. Flex Layout, Schematics & Parts Lists Updated Bottom Flex diagram and parts list.	
6866534D39-B	Document History added.	Apr. 2003
	Safety Information updated to new TETRA Standard.	
	Chapter 4.1. Transceiver 400 MHz Updated board diagram to 8466547A08. Changed some part values for UHF Main VCO schematic diagram and changed parts list.	
	Chapter 6. Maintenance: Updated mechanical parts list.	
6866534D39-C	Chapter 1: Scope and Warranty Information Updated Asia Pacific Radio Support Centers information with deletion of toll-free and non-toll-freee contact nos.	July 2003
	Chapter 2: Model Information & Accessories Updated 400MHz and 800MHz Model Charts. Updated MTP700 Accessories-To-Model Chart table.	
	Chapter 4.1 & 4.2: Transceiver 400 MHz and Transceiver 800MHz Added memory components update information to Digital and Audio Section of theory of operation, block diagrams, schematics and parts list.	
	Chapter 6: Maintenance Changed Frequency Knob part no. and added Keypad English/Chinese and Keypad English/ Korean part nos. to Exploded View Components List.	
	Appendix A: Replacement Parts & Kits Updated table on Service Boards and Front Cover Kits.	

Edition	Description	Date
6866534D40-D	Chapter 6: Maintenance Deleted front housing kit assembly and disassembly instructions. Changed exploded view diagram and mechanical parts list.	Oct. 2003

SAFETY

Product Safety and RF Exposure for Portable Two-Way Radios

BEFORE USING THIS RADIO, READ THIS BOOKLET WHICH CONTAINS IMPORTANT OPERATING INSTRUCTIONS FOR SAFE USAGE AND RF ENERGY AWARENESS AND CONTROL INFORMATION FOR COMPLIANCE WITH RF ENERGY EXPOSURE LIMITS IN APPLICABLE NATIONAL AND INTERNATIONAL STANDARDS.

The information provided in this document supersedes the general information contained in user guides published prior to February 2002.

For radios that have been approved as intrinsically safe, read the instructions and information on intrinsic safety.

Compliance with RF Energy Exposure Standards

NOTICE: This radio is intended for use in occupational/controlled applications where users have been made aware of the potential for exposure and can exercise control over their exposure. This radio device is NOT authorized for general population, consumer or similar use.

Federal Communication Commission (FCC) Regulations

The FCC has established limits for safe exposure to radio frequency (RF) emissions from portable two-way radios. The FCC requires manufacturers to demonstrate compliance with RF exposure limits before portable two-way radios can be marketed in the U.S. When two-way radios are approved for occupational/controlled environment exposure limits, the FCC requires users to be fully aware of, and exercise control over, their exposure. Awareness and control of RF exposure can be accomplished by the use of labels, or by education or training through appropriate means, such as information and instructions in user manuals or safety booklets.

Your Motorola two-way radio has an RF exposure information label in the battery compartment. This user safety booklet includes useful information about RF exposure and helpful instructions on how to control your RF exposure.

Your Motorola two-way radio is designed and tested to comply with a number of national and international standards and guidelines (listed below) regarding human exposure to radio frequency electromagnetic energy. **This radio complies with the IEEE (FCC) and ICNIRP exposure limits for occupational/controlled RF exposure environments at usage factors of up to 50% talk–50% listen.** In terms of measuring RF energy for compliance with FCC exposure guidelines, **your radio radiates measurable RF energy only while it is transmitting (during talking), not when it is receiving (listening) or in standby mode.**

NOTE: The approved batteries, supplied with the portable radio, are rated for a 5-5-90 duty cycle (5% talk–5% listen–90% standby), even though this radio complies with FCC occupational exposure limits at usage factors of up to 50% talk.

Your Motorola two-way radio complies with the following RF energy exposure standards and guidelines:

- United States Federal Communications Commission, Code of Federal Regulations; 47 CFR part 2 sub-part J
- American National Standards Institute (ANSI) / Institute of Electrical and Electronic Engineers (IEEE) C95. 1-1992
- Institute of Electrical and Electronic Engineers (IEEE) C95.1-1999 Edition
- International Commission on Non-Ionizing Radiation Protection (ICNIRP) 1998
- Ministry of Health (Canada) Safety Code 6. Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz, 1999
- Australian Communications Authority Radiocommunications (Electromagnetic Radiation - Human Exposure) Standard, 2001
- ANATEL, Brasil Regulatory Authority, Resolution 256 (April 11, 2001) “additional requirements for SMR, cellular and PCS product certification.”

Compliance and Control Guidelines and Operating Instructions for Portable Two-Way Radios

To control your exposure and ensure compliance with the occupational/ controlled environment exposure limits, always adhere to the following procedures:

- Transmit no more than 50% of the time. To transmit (talk), push the Push-To-Talk (PTT) button. To receive calls, release the PTT button. Transmitting 50% of the time or less is important since the radio generates measurable RF energy exposure only when transmitting (in terms of measuring standards compliance).
- **Hold the radio in a vertical position in front of the face with the microphone (and other parts of the radio including the antenna) at least one to two inches (2.5 to 5 centimeters) away from the lips. Keeping the radio at a proper distance is important since RF exposures decrease with distance from the antenna.**

- For body-worn operation, always place the radio in a Motorola-approved clip, holder, holster, case, or body harness for this product. Using non-Motorola-approved accessories may result in exposure levels which exceed the FCC’s occupational/controlled environment RF exposure limits.
- If you are not using a body-worn accessory and are not using the radio in the intended use position in front of the face, ensure the antenna and the radio are kept one inch (2.5 centimeters) from the body when transmitting. Keeping the radio at a proper distance is important since RF exposures decrease with distance from the antenna.
- **Use only Motorola-approved supplied or replacement antennas, batteries, and accessories.** Use of non–Motorola-approved antennas, batteries and accessories may exceed FCC RF exposure guidelines. **For a list of Motorola-approved antennas, batteries, and other accessories, visit the following web site which lists approved accessories: http://ap.cgiss.motorola.com/AAD/index.html**

For additional information on exposure requirements or other training information, visit http://www.motorola.com/rfhealth.

Electromagnetic Interference/Compatibility

NOTE: Nearly every electronic device is susceptible to electromagnetic interference (EMI) if inadequately shielded, designed, or otherwise configured for electromagnetic compatibility.

Facilities

To avoid electromagnetic interference and/or compatibility conflicts, turn off your radio in any facility where posted notices instruct you to do so. Hospitals or health care facilities may be using equipment that is sensitive to external RF energy.

Aircraft

When instructed to do so, turn off your radio when on board an aircraft. Any use of a radio must be in accordance with applicable regulations per airline crew instructions.

Medical Devices

Pacemakers

The Advanced Medical Technology Association (AdvaMed) recommends that a minimum separation of 6 inches (15 centimeters) be maintained between a handheld wireless radio and a pacemaker. These recommendations are consistent with those of the U.S. Food and Drug Administration.

Persons with pacemakers should:

- ALWAYS keep the radio more than 6 inches (15 centimeters) from their pacemaker when the radio is turned ON.
- not carry the radio in the breast pocket.
- use the ear opposite the pacemaker to minimize the potential for interference.
- turn the radio OFF immediately if you have any reason to suspect that interference is taking place.

Hearing Aids

Some digital wireless radios may interfere with some hearing aids. In the event of such interference, you may want to consult your hearing aid manufacturer to discuss alternatives.

Other Medical Devices

If you use any other personal medical device, consult the manufacturer of your device to determine if it is adequately shielded from RF energy. Your physician may be able to assist you in obtaining this information.

Driver Safety

Check the laws and regulations on the use of radios in the area where you drive. Always obey them.

When using your radio while driving, please:

- Give full attention to driving and to the road.
- Use hands-free operation, if available.
- Pull off the road and park before making or answering a call if driving conditions so require.

Operational Warnings

For Vehicles With An Air Bag

Do not place a portable radio in the area over an air bag or in the air bag deployment area. Air bags inflate with great force. If a portable radio is placed in the air bag deployment area and the air bag inflates, the radio may be propelled with great force and cause serious injury to occupants of the vehicle.

Potentially Explosive Atmospheres

Turn off your radio prior to entering any area with a potentially explosive atmosphere, unless it is a portable radio type especially qualified for use in such areas as "Intrinsically Safe" (for example, Factory Mutual, CSA, UL, or CENELEC). Do not remove, install, or charge batteries in such areas. Sparks in a potentially explosive atmosphere can cause an explosion or fire resulting in bodily injury or even death.

The areas with potentially explosive atmospheres referred to above include fueling areas such as below decks on boats, fuel or chemical transfer or storage facilities, and areas where the air contains chemicals or particles such as grain, dust or metal powders. Areas with potentially explosive atmospheres are often but not always, posted.

Blasting Caps And Blasting Areas

To avoid possible interference with blasting operations, turn off your radio when you are near electrical blasting caps, in a blasting area, or in areas posted: "Turn off two-way radio." Obey all signs and instructions.

Operational Cautions

Antennas

Do not use any portable radio that has a damaged antenna. If a damaged antenna comes into contact with your skin, a minor burn can result.

Batteries

All batteries can cause property damage and/or bodily injury such as burns if a conductive material such as jewelry, keys, or beaded chains touch exposed terminals. The conductive material may complete an electrical circuit (short circuit) and become quite hot. Exercise care in handling any charged battery, particularly when placing it inside a pocket, purse, or other container with metal objects.

Intrinsically Safe Radio Information

FMRC Approved Equipment

Anyone intending to use a radio in a location where hazardous concentrations of flammable materials exist (hazardous atmosphere) is advised to become familiar with the subject of intrinsic safety and with the National Electric Code NFPA 70 (National Fire Protection Association) Article 500 (hazardous [classified] locations).

An Approval Guide, issued by Factory Mutual Research Corporation (FMRC), lists manufacturers and the products approved by FMRC for use in such locations. FMRC has also issued a voluntary approval standard for repair service ("Class Number 3605").

FMRC Approval labels are attached to the radio to identify the unit as being FMRC Approved for specified hazardous atmospheres. This label specifies the hazardous Class/Division/Group along with the part number of the battery that must be used. Depending on the design of the portable unit, this FM label can be found on the back or the bottom of the radio housing. The FM Approval Mark is shown here.

- **Do not operate radio communications equipment in hazardous atmospheres unless it is a type specifically qualified (e.g., FM Approved) for such use. An explosion or fire may result.**
- **Do not operate the FMRC Approved Product in a hazardous atmosphere if it has been physically damaged (e.g., cracked housing). An explosion or fire may result.**
- **Do not replace or charge batteries in a hazardous atmosphere. Contact sparking may occur while installing or removing batteries, and cause an explosion or fire.**
- **Do not replace or change accessories in a hazardous atmosphere. Contact sparking may occur while installing or removing accessories, and cause an explosion or fire.**
- **Turn the radio off before removing or installing a battery or accessory.**
- **Do not disassemble an FMRC Approved Product in any way that exposes the internal circuits of the unit.**

Radios must ship from the Motorola manufacturing facility with the hazardous atmosphere capability and FM Approval labeling. Radios will not be “upgraded” to this capability and labeled in the field. A modification changes the unit’s hardware from its original design configuration. Modifications can only be made by the original product manufacturer at one of its FMRC-audited manufacturing facilities.

- **Failure to use an FMRC Approved Product with an FMRC Approved battery or FMRC Approved accessories specifically approved for that product may result in the dangerously unsafe condition of an unapproved radio combination being used in a hazardous location.**
- **Unauthorized or incorrect modification of an FMRC Approved Product will negate the Approval rating of the product**

Repair of FMRC Approved Products

REPAIRS FOR MOTOROLA PRODUCTS WITH FMRC APPROVAL ARE THE RESPONSIBILITY OF THE USER.

You should not repair or relabel any Motorola-manufactured communication equipment bearing the FMRC Approval label (“FMRC Approved Product”) unless you are familiar with the current FMRC Approval standard for repairs and service (“Class Number 3605”).

You may want to consider using a repair facility that operates under 3605 repair service approval.

- **Incorrect repair or relabeling of any FMRC Approved Product could adversely affect the Approval rating of the unit.**
- **Use of a radio that is not intrinsically safe in a hazardous atmosphere could result in serious injury or death.**

The FMRC’s Approval Standard Class Number 3605 is subject to change at any time without notice to you. You may want to obtain a current copy of 3605 from the FMRC. Per the December 1994 publication of 3605, some key definitions and service requirements are as follows:

Repair

A repair constitutes something done internally to the unit that would bring it back to its original condition—Approved by FMRC. A repair should be done in an FMRC Approved repair facility.

Items not considered as repairs are those in which an action is performed on a unit which does not require the outer casing of the unit to be opened in a manner which exposes the internal electrical circuits of the unit. You do not have to be an FMRC Approved repair facility to perform these actions.

Relabeling

The repair facility shall have a method by which the replacement of FMRC Approval labels are controlled to ensure that any relabeling is limited to units that were originally shipped from the manufacturer with an FM Approval label in place. FMRC Approval labels shall not be stocked by the repair facility. An FMRC Approval label shall be ordered from the original manufacturer, as needed, to repair a specific unit. Replacement labels may be obtained and applied by the repair facility, provided there is satisfactory evidence that the unit being relabeled was originally an FMRC Approved unit. Verification may include, but is not limited to a unit with a damaged Approval label, a unit with a defective housing displaying an Approval label, or a customer invoice indicating the serial number of the unit and purchase of an FMRC Approved model.

Do Not Substitute Options or Accessories

The Motorola communications equipment certified by Factory Mutual is tested as a system and consists of the FM Approved portable, FM Approved battery, and FM Approved accessories or options, or both. This FM Approved portable and battery combination must be strictly observed. There must be no substitution of items, even if the substitute has been previously Approved with a different Motorola communications equipment unit. Approved configurations are listed in the FM Product Listing Manual that was included with your radio.

CE European Union Directives Conformance Statement

This product is in conformance with the TETRA (TErrestrial Trunked RAdio) standard.
This product is in conformance with the requirements of the applicable EU Council Directives.
Declarations of Conformance with the requirements are located at:

Motorola a/s
Sydvestvej 15
DK-2600 Glostrup

Denmark

CONTENTS

COPYRIGHT Computer Software Copyrights ii
Trademarks. ii

HISTORY **DOCUMENT HISTORY . . . . . iii**

SAFETY Product Safety and RF Exposure for Portable Two-Way Radios v

CHAPTER 1 **SCOPE & WARRANTY INFORMATION 1-1**

Scope Of This Manual 1-1
Manual Revisions 1-1
Related Publications 1-2
Warranty and Service Support 1-3
European Radio Support Centers (ERSC) 1-4
Asia Pacific Radio Support Centers 1-5
Latin America Radio Support Centers 1-6

CHAPTER 2 **MODEL INFORMATION & ACCESSORIES. 2-1**

MTP700 Portable Radio Model Charts 2-1
MTP700 Portable Radio Model Information 2-5
MTP700 Portable Radio Model Specification 2-6
MTP700 Accessories-To-Model Chart 2-7

CHAPTER 3 **OVERVIEW 3-1**

General 3-1
Digital Modulation Technology 3-1

CHAPTER 4 **RADIO INFORMATION. 4-1**

Section Introduction 4-1

CHAPTER 4.1 **TRANSCEIVER 400 MHz 4.1-1**

General 4.1-1
Block Diagram Overview 4.1-1
Receiver Section 4.1-3
Transmitter Section. 4.1-3
Frequency Generating Section (Synthesizer). 4.1-4
Digital & Audio Section 4.1-4
Block Diagrams Descriptions 4.1-5

Receiver Path 4.1-5
Transmitter Path 4.1-6
Frequency Generating Section 4.1-7
Digital & Audio Section 4.1-9
Detailed Circuit Description 4.1-10
Receiver Path, Detailed Circuit Description 4.1-10
Transmitter Path, Detailed Circuit Description 4.1-13
Frequency Generating Section, Detailed Circuit Description 4.1-16
Digital & Audio Section, Detailed Circuit Description 4.1-18
Display and Keypad, Detailed Description 4.1-26
380-430 MHz Board Layout, Schematics & Parts Lists 4.1-31
380-430 MHz Main Board Top Side PCB No. 8466547A08 . . . . . 4.1-31
380-430 MHz Main Board Bottom Side PCB No. 8466547A08 . . . 4.1-32
Digital and RF Block Diagram 4.1-33
DSP, Controller & Memory Schematic Diagram (RedCap2) 4.1-34
DSP, Controller & Memory Schematic Diagram (Memory) 4.1-35
GCAP (Audio & DC) Schematic Diagram - GCAP3 . . . . . 4.1-36
GCAP (Audio & DC) Schematic Diagram - Periphery 4.1-37
IO Interface & Connectors
Schematic Diagram - 40 Pin Connector 4.1-38
IO Interface & Connectors
Schematic Diagram - 16 Pin Connector 4.1-39
Switches & Associated Components
Schematic Diagram - Switch 4.1-40
Switches & Associated Components
Schematic Diagram - 24 Pin Connector 4.1-41
RF Section Block Diagram 4.1-42
RXU Schematic Diagram 4.1-43
RF Core Unit Schematic Diagram - WPIC 4.1-44
RF Core Unit Schematic Diagram - 2nd LO 4.1-45
Main VCO Schematic Diagram 4.1-46
TXU Block Diagram. 4.1-47
TXU-LNODCT Schematic Diagram. 4.1-48
TXU-TX Power Amplifier Schematic Diagram. 4.1-49
TXU-TX Front End Schematic Diagram 4.1-50
TXU-ESCORT/TX VCO Schematic Diagram 4.1-51
380-430 MHz Radio Parts List 4.1-52
Troubleshooting (400 MHz) 4.1-59
General 4.1-59
Test Procedures 4.1-59
Troubleshooting Flowcharts 4.1-59

CHAPTER 4.2 TRANSCEIVER 800 MHz 4.2-1

General 4.2-1
Block Diagram Overview 4.2-1
- Receiver Section 4.2-3
- Transmitter Section. 4.2-3
- Frequency Generating Section. 4.2-4
- Digital & Audio Section 4.2-5

Block Diagrams Description 4.2-6
- Receiver Path 4.2-6
- Transmitter Path 4.2-7
- Frequency Generating Section. 4.2-8
- Digital & Audio Section 4.2-10

Detailed Circuit Description 4.2-11
- Receiver Path, Detailed Circuit Description 4.2-11
- Transmitter Path, Detailed Circuit Description 4.2-14
- Frequency Generating Section, Detailed Circuit Description 4.2-17
- Digital & Audio Section, Detailed Circuit Description 4.2-19
- Display and Keypad, Detailed Description 4.2-27

806-870 MHz Board Layout, Schematics & Parts Lists 4.2-33
- 806-870 MHz Main Board Top Side PCB No. 8485951Z04 . . . . . 4.2-33
- 806-870 MHz Main Board Bottom Side PCB No. 8485951Z04 . . . 4.2-34
- Controller Memory Schematic Diagram (Redcap 2) sheet 1 of 2 . . 4.2-35
- Controller Memory Schematic Diagram (Redcap 2) sheet 2 of 2 . . 4.2-36
- DC Supply & Audio Schematic Diagram (GCAP 3) sheet 1 of 2 . . 4.2-37
- DC Supply & Audio Schematic Diagram (GCAP 3) sheet 2 of 2 . . 4.2-38
- I/O Interface Schematic Diagram sheet 1 of 2 . . . . . 4.2-39
- I/O Interface Schematic Diagram (sheet 2 of 2) 4.2-40
- Switches And Associated Components Schematic Diagram (sheet 1 of 2) 4.2-41
- Switches And Associated Components Schematic Diagram (sheet 2 of 2) 4.2-42
- Receiver Front End Schematic Diagram 4.2-43
- Receiver Back End Schematic Diagram. 4.2-44
- Transmitter Schematic Diagram (sheet 1 of 2) 4.2-45
- Transmitter Schematic Diagram (sheet 2 of 2) 4.2-46
- Frequency Generation Unit Schematic Diagram 4.2-47
- ESCORT Schematic Diagram 4.2-48
- 806-870 MHz Radio Parts List 4.2-49

Troubleshooting (800 MHz) 4.2-55
- General. 4.2-55

Test Procedures 4.2-55
Troubleshooting Flowcharts 4.2-55

CHAPTER 5 PROGRAMMING THE RADIO 5-1

Before Using the Customer Programming Software (CPS) 5-1
Reading Codeplug 5-2
Programming Codeplug 5-2
Programming Frequency 5-3
Restoring Factory Frequencies of the Radio. 5-4
Programming Firmware. 5-4
Manual Mode Testing 5-5
Preparation for Testing 5-5
Tests 5-5
LCD Display Test. 5-5

CHAPTER 6 MAINTENANCE 6-1

Introduction 6-1
Preventive Maintenance 6-1
Safe Handling of CMOS and LDMOS Devices 6-3
Repair Procedures and Techniques — General 6-4
Parts Replacement and Substitution. 6-4
Disassembling and Reassembling the Radio - General 6-4
Radio Disassembly - Detailed 6-5
Front Cover from Chassis Disassembly 6-5
Chassis Assembly Disassembly 6-8
Radio Reassembly - Detailed 6-9
Chassis Assembly Reassembly 6-9
Chassis and Front Cover Reassembly 6-9
Service Aids 6-11
MTP700 Unit - Exploded View 6-12

CHAPTER 7 KEYPAD BOARD LAYOUT, SCHEMATICS & PARTS LIST 7-1

Keypad Board Top Side PCB No. 8466556A01 7-1
Keypad Board Bottom Side PCB No. 8466556A01 7-2
Keypad Board Schematic Diagram 7-3
Keypad Board Parts List 7-4

CHAPTER 8 FLEX LAYOUT, SCHEMATICS & PARTS LISTS 8-1

Interconnect Flex 8-1
Schematic for Interconnect Flex 8-2
Parts List for Interconnect Flex 8-2
Universal Connector Flex 8-3
Schematic for Universal Connector Flex 8-4
Parts List for Universal Connector Flex 8-4
Display Flex 8-5
Schematic for Display Flex 8-6
Parts List for Display Flex 8-6
Bottom Flex 8-7
Schematic for Bottom Flex 8-8
Parts List for Bottom Flex 8-8

APPENDIX A REPLACEMENT PARTS AND KITS A-1

Servicing MTP700 Portable Units A-1
Replacement Parts A-1
Service Kits A-2

APPENDIX B CONNECTOR PIN FUNCTIONS B-1

General B-1
Side Accessory Connector Pin Assignment B-1
Bottom Accessory Connector Pin Assignment B-3

APPENDIX C TEST EQUIPMENT C-1

Test Equipment C-1

APPENDIX D SELF CHECK (ERROR & FAIL CODES) D-1

General D-1
Self Check Error Codes D-1

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CHAPTER 1
SCOPE & WARRANTY INFORMATION

Scope Of This Manual

This manual contains information necessary to identify and troubleshoot the MTP700 Dimetra Portable Radio at the component level. It also contains information on radio assembling, disassembling, and maintenance. Depending on the radio application, these radios are designed to work with Motorola's Dimetra system or other TETRA compliant systems.

Accordingly, information in this manual is divided into the following chapters and appendixes:

- SAFETY Product Safety and RF Exposure for Portable Two-Way Radios
- CHAPTER 1 Scope & Warranty Information
- CHAPTER 2 Model Information & Accessories
- CHAPTER 3 Overview
- CHAPTER 4 Radio Information
- CHAPTER 4.1 Transceiver 400 MHz
- CHAPTER 4.2 Transceiver 800 MHz
- CHAPTER 5 Programming the Radio
- CHAPTER 6 Maintenance
- CHAPTER 7 Keypad Board Layout, Schematics and Parts List
- CHAPTER 8 Flex Layout, Schematics and Parts Lists
- APPENDIX A Replacement Parts and Kits
- APPENDIX B Connector Pin Functions
- APPENDIX C Test Equipment
- APPENDIX D Self Check (Error/Fail Codes)

Manual Revisions

Changes which occur after this manual is printed are described in Manual Revisions. These Manual Revisions provide complete information on changes including pertinent parts listing data.

Related Publications

6866534D27	MTP700 User's Guide incl. Quick Reference Card (English)
6866534D28	MTP700 User's Guide incl. Quick Reference Card (German)
6866534D29	MTP700 User's Guide incl. Quick Reference Card (French)
6866534D30	MTP700 User's Guide incl. Quick Reference Card (Dutch)
6866534D31	MTP700 User's Guide incl. Quick Reference Card (Spanish)
6866534D32	MTP700 User's Guide incl. Quick Reference Card (Portuguese)
6804112J75	MTP700 User's Guide incl. Quick Reference Card (Mandarin)
6866534D40	MTP700 Basic Service Manual (English)
6802956C20	MTP700 Customer Programming Software (CPS) Start-up manual
6864117B25	Safety Leaflet (European Languages)
6804110J47	Safety Leaflet (English/Mandarin)
6802300U57	EME Warnings, Pocket Size
6866534D69	R&TTE Leaflet (for EMEA region only)
6866534D94	Factory Mutual Supplement

Warranty and Service Support

Motorola offers long term support for its products. This support includes full exchange and/or repair of the product during the warranty period, and service/repair or spare parts support out of warranty. Any "return for exchange" or "return for repair" by an authorised Motorola Dealer must be accompanied by a Warranty Claim Form. Warranty Claim Forms are obtained by contacting an Authorised Motorola Dealer.

Warranty Period and Return Instructions

The terms and conditions of warranty are defined fully in the Motorola Dealer or Distributor or Reseller contract. These conditions may change from time to time and the following notes are for guidance purposes only.

In instances where the product is covered under a "return for replacement" or "return for repair" warranty, a check of the product should be performed prior to shipping the unit back to Motorola. This is to ensure that the product has been correctly programmed or has not been subjected to damage outside the terms of the warranty.

Prior to shipping any radio back to the appropriate Motorola warranty depot, please contact Customer Resources. All returns must be accompanied by a Warranty Claim Form, available from your Customer Services representative. Products should be shipped back in the original packaging, or correctly packaged to ensure no damage occurs in transit.

After Warranty Period

After the Warranty period, Motorola continues to support its products in two ways.

1. Motorola’s Regional Radio Support Centers offer repair services to both end users and dealers at competitive prices.
2. AAD supplies individual parts and modules that can be purchased by dealers who are technically capable of performing fault analysis and repair.

European Radio Support Centers (ERSC)

The ERSC Customer Information Desk is available through the following service numbers:

Austria:	06 60 75 41	Italy:	16 78 77 387
Belgium:	08 00 72 471	Luxemburg:	08 00 23 27
Denmark:	80 01 55 72	Netherlands:	60 22 45 13
Finland:	08 00 11 49 10	Norway:	80 01 11 15
France:	05 90 30 90	Portugal:	05 05 49 35 70
Germany:	08 00 18 75 240	Spain:	90 09 84 902
Greece:	00 80 04 91 29 020	Sweden:	02 07 94 307
UK :	08 00 96 90 95	Switzerland:	1 55 30 82
Ireland:	18 00 55 50 21	Iceland:	80 08 147

Or dial Customer Care Center:

Tel: +49 6128 70 2164

Please use these numbers for repair enquiries only.

Piece Parts

Some replacement parts, spare parts, and/or product information can be ordered directly. If a complete Motorola part number is assigned to the part, it is available from Motorola Radio Aftermarket and Accessory Division (AAD). If no part number is assigned, the part is not normally available from Motorola. If a parts list is not included, this generally means that no user-serviceable parts are available for that kit or assembly.

Note on this digital TETRA Radio: **The CPS has no capability to tune the radio. Tuning the radio can only be performed at the factory or at the appropriate Motorola Repair Center. Component replacement can affect the radio tuning and must only be performed by the appropriate Motorola Repair Center.**

Parts Identification and Ordering

Request for help in identification of non-referenced spare parts should be directed to the Customer Care Organisation of Motorola’s local area representation. Orders for replacement parts, kits and assemblies should be placed directly on Motorola’s local distribution organisation or via Motorola Online (Extranet).

EMEA Test Equipment Support

Information related to support and service of Motorola Test Equipment is available via Motorola Online (Extranet), through the Customer Care Organisation of Motorola’s local area representation or by calling the Motorola switchboard in Germany using phone number +49 6128 700.

Asia Pacific Radio Support Centers

Piece Parts

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All orders for parts/information should include the complete Motorola identification number. All part orders should be directed to your local AAD office. Please refer to your latest price pages.

Technical Support

Technical support is available to assist the dealer/distributor in resolving any malfunction which may be encountered. Initial contact should be by telephone wherever possible. When contacting Motorola Technical Support, be prepared to provide the product **model number** and the unit's **serial number**.

Further Assistance From Motorola

You can also call the CGISS Indirect Business Customer Help Desk number, (604)-6302525 or send an email to customercare.asia@motorola.com.

Latin America Radio Support Centers

The Customer Support is available through the following service numbers:

Warranty and Repairs:
Motorola De Colombia Service Center
Diagonal 127A no. 17-64
Santa Fe de Bogotá
Colombia
(571) 520-0510 or (571) 657-5759

Motorola De Mexico Service Center
Bosques de Alisos #125
Col. Bosques de las Lomas
CP 05120 Mexico DF
5252576700

Piece Parts:
To order parts in Latin America and the Carribean:
7:00 A.M. to 7:00 P.M. (Central Standard Time)
Monday through Friday (Chicago, USA)
1-847-538-8023

Technical Support:
lataech1@email.mot.com <mailto:latech1@email.mot.com>

Motorola Parts (Accessories and Aftermarket Division AAD):
Attention: Order Processing
1313 E. Algonquin Road
Schaumburg. IL. 60196

Parts Identification:
1-847-538-0021 (Voice)
1-847-538-8194 (Fax)

Piece Parts

Some replacement parts, spare parts, and/or product information can be ordered directly. If a complete Motorola Part number is assigned to the part, it is available from Motorola Radio Aftermarket and Accessory Division (AAD). If no part number is assigned, the part is not normally available from Motorola. If a parts list is not included, this generally means that no user-serviceable parts are available for that kit or assembly.

Note on this digital TETRA Radio: **The CPS has no capability to tune the radio. Tuning the radio can only be performed at the factory or at the appropriate Motorola Repair Center. Component replacement can affect the radio tuning and must only be performed by the appropriate Motorola Repair Center.**

CHAPTER 2
MODEL INFORMATION & ACCESSORIES

MTP700 Portable Radio Model Charts

MTP700, 380-430 MHz					
Model					**Description**
H47QCM6TZ6AN					MTP700 380-430 MHz 1W 25K CR PT911E
	*H47QCM6TZ6AB				MTP700 380-430 MHz 1W 25K CR PT911E
		H47QCM6TZ5AN			MTP700 380-430 MHz 1W 25K ES PT911E
			*H47QCM6TZ5AB		MTP700 380-430 MHz 1W 25K ES PT911E
				Item	**Description**
x				**PMUE1852_	***MTP700 Super Tanapa 380-430 MHz 1W 25K CR-TEA1
		x		**PMUE1853_	***MTP700 Super Tanapa 380-430 MHz 1W 25K ES-TEA1
x				**PMUE1856_	***MTP700 Super Tanapa 380-430 MHz 1W 25K CR-TEA2
		x		**PMUE1857_	***MTP700 Super Tanapa 380-430 MHz 1W 25K ES-TEA2
x	x			**PMUE1825_	***MTP700 Super Tanapa 380-430 MHz 1W 25K CR
		x	x	**PMUE1826_	***MTP700 Super Tanapa 380-430 MHz 1W 25K ES
x				**PMUE2052_	MTP700 Super Tanapa 380-430 MHz 1W 25K CR (Chinese)
		x		**PMUE2053_	MTP700 Super Tanapa 380-430 MHz 1W 25K ES (Chinese)
x				**PMUE2054_	MTP700 Super Tanapa 380-430 MHz 1W 25K CR (Korean)
		x		**PMUE2055_	MTP700 Super Tanapa 380-430 MHz 1W 25K ES (Korean)
x				**PMUE2056_	MTP700 Super Tanapa 380-430 MHz 1W 25K CR-TEA1 (Chinese)
		x		**PMUE2057_	MTP700 Super Tanapa 380-430 MHz 1W 25K ES-TEA1 (Chinese)
x				**PMUE2058_	MTP700 Super Tanapa 380-430 MHz 1W 25K CR-TEA1 (Korean)
		x		**PMUE2059_	MTP700 Super Tanapa 380-430 MHz 1W 25K ES-TEA1 (Korean)
x	x			**PMUE1865_	***MTP700 Tanapa 380-430 MHz 1W 25K CR
		x	x	**PMUE1827_	***MTP700 Tanapa 380-430 MHz 1W 25K ES
		x		**PMUE2086_	MTP700 Tanapa 380-430 MHz 1W 25K ES (Chinese)
x				**PMUE2087_	MTP700 Tanapa 380-430 MHz 1W 25K CR (Chinese)
		x		**PMUE2088_	MTP700 Tanapa 380-430 MHz 1W 25K ES (Korean)
x				**PMUE2089_	MTP700 Tanapa 380-430 MHz 1W 25K CR (Korean)
		x		PMHE4012_	Back Chassis Kit 380-430 MHz 1W 25K ES
x				PMHE4013_	Back Chassis Kit 380-430 MHz 1W 25K CR
x				PMHN4048_	MTP700 Front Housing Kit CR (English/Chinese)
x				PMHN4049_	MTP700 Front Housing Kit CR (English/Korean)
x	x			PMHN4038_	MTP700 Front Housing Kit CR

MTP700, 380-430 MHz (Continued)					
Model					Description
H47QCM6TZ6AN					MTP700 380-430 MHz 1W 25K CR PT911E
	*H47QCM6TZ6AB				MTP700 380-430 MHz 1W 25K CR PT911E
		H47QCM6TZ5AN			MTP700 380-430 MHz 1W 25K ES PT911E
			*H47QCM6TZ5AB		MTP700 380-430 MHz 1W 25K ES PT911E
				Item	**Description**
		x	x	PMHN4039_	MTP700 Front Housing Kit ES
		x		PMHN4050_	MTP700 Front Housing Kit ES (English/Chinese)
		x		PMHN4051_	MTP700 Front Housing Kit ES (English/Korean)
x	x	x	x	FAE6000_	Narrow Band Antenna 380-400 MHz
x	x	x	x	FAE6001_	Narrow Band Antenna 410-430 MHz
x	x	x	x	FAE5520_	Whip Antenna 380-400 MHz
x	x	x	x	FAE6002_	Whip Antenna 410-430 MHz
x	x	x	x	6866534D27	MTP700 User Guide (English)
x	x	x	x	6866534D28	MTP700 User Guide (German)
x	x	x	x	6866534D29	MTP700 User Guide (French)
x	x	x	x	6866534D30	MTP700 User Guide (Dutch)
x	x	x	x	6866534D31	MTP700 User Guide (Spanish)
x	x	x	x	6866534D32	MTP700 User Guide (Portuguese)
x	x	x	x	6804112J75	MTP700 User Guide (Mandarin)

Note:

x Indicates one of each is required.

* For Asia, please use H415EK Option for Bulk Package.

** For replacement kits, see Appendix A Replacement Parts and Kits.

*** Not Field Replaceable for Latin America

MTP700, 806-870 MHz

Model						Description
H47XCM6TZ5AK						MTP700 806-870 MHz 1W 25K ES PT711E (Korea)
	H47XCM6TZ6AN					MTP700 806-870 MHz 1W 25K CR PT711E
		*H47XCM6TZ6AB				MTP700 806-870 MHz 1W 25K CR PT711E
			H47XCM6TZ5AN			MTP700 806-870 MHz 1W 25K ES PT711E
				*H47XCM6TZ5AB		MTP700 806-870 MHz 1W 25K ES PT711E
					Item	**Description**
	x				**PMUF1092_	***MTP700 Super Tanapa 806-870 MHz 1W 25K CR-TEA1
			x		**PMUF1093_	***MTP700 Super Tanapa 806-870 MHz 1W 25K ES-TEA1
	x				**PMUF1096_	***MTP700 Super Tanapa 806-870 MHz 1W 25K CR-TEA2
			x		**PMUF1097_	***MTP700 Super Tanapa 806-870 MHz 1W 25K ES-TEA2
	x	x			**PMUF1077_	***MTP700 Super Tanapa 806-870 MHz 1W 25K CR
			x	x	**PMUF1078_	***MTP700 Super Tanapa 806-870 MHz 1W 25K ES
x					**PMUF1115_	MTP700 Super Tanapa 806-870 MHz 1W 25K ES
	x				**PMUF1157_	MTP700 Super Tanapa 806-870 MHz 1W 25K CR (Chinese)
			x		**PMUF1158_	MTP700 Super Tanapa 806-870 MHz 1W 25K ES (Chinese)
	x				**PMUF1159_	MTP700 Super Tanapa 806-870 MHz 1W 25K CR (Korean)
			x		**PMUF1160_	MTP700 Super Tanapa 806-870 MHz 1W 25K ES (Korean)
	x				**PMUF1161_	MTP700 Super Tanapa 806-870 MHz 1W 25K CR-TEA1 (Chinese)
			x		**PMUF1162_	MTP700 Super Tanapa 806-870 MHz 1W 25K ES-TEA1 (Chinese)
	x				**PMUF1163_	MTP700 Super Tanapa 806-870 MHz 1W 25K CR-TEA1 (Korean)
			x		**PMUF1164_	MTP700 Super Tanapa 806-870 MHz 1W 25K ES-TEA1 (Korean)
	x	x			**PMUF1102_	***MTP700 Tanapa 806-870 MHz 1W 25K CR
			x	x	**PMUF1079_	***MTP700 Tanapa 806-870 MHz 1W 25K ES
x					**PMUF1116_	MTP700 Tanapa 806-870 MHz 1W 25K ES
			x		**PMUF1165_	MTP700 Tanapa 806-870 MHz 1W 25K ES (Chinese)
	x				**PMUF1166_	MTP700 Tanapa 806-870 MHz 1W 25K CR (Chinese)
			x		**PMUF1167_	MTP700 Tanapa 806-870 MHz 1W 25K ES (Korean)
	x				**PMUF1168_	MTP700 Tanapa 806-870 MHz 1W 25K CR (Korean)
			x		PMHF4000_	Back Chassis Kit 806-870 Mhz 1W 25W ES
	x				PMHF4001_	Back Chassis Kit 806-870 Mhz 1W 25W CR
	x				PMHN4048_	MTP700 Front Housing Kit CR (English/Chinese)
	x				PMHN4049_	MTP700 Front Housing Kit CR (English/Korean)
	x	x			PMHN4038_	MTP700 Front Housing Kit CR
			x	x	PMHN4039_	MTP700 Front Housing Kit ES
x					PMHN4040_	MTP700 Front Housing Kit ES

MTP700, 806-870 MHz (Continued)						
Model						Description
H47XCM6TZ5AK						MTP700 806-870 MHz 1W 25K ES PT711E (Korea)
	H47XCM6TZ6AN					MTP700 806-870 MHz 1W 25K CR PT711E
		*H47XCM6TZ6AB				MTP700 806-870 MHz 1W 25K CR PT711E
			H47XCM6TZ5AN			MTP700 806-870 MHz 1W 25K ES PT711E
				*H47XCM6TZ5AB		MTP700 806-870 MHz 1W 25K ES PT711E
					Item	**Description**
			x		PMHN4050_	MTP700 Front Housing Kit ES (English/Chinese)
			x		PMHN4051_	MTP700 Front Housing Kit ES (English/Korean)
	x	x	x	x	NAF5037_	1/2 Wave Whip Antenna 806-870 MHz
x	x	x	x	x	NAF5042_R	1/4 Wave Stubby Antenna 806-870 MHz
x	x	x	x	x	6866534D27	MTP700 User Guide (English)
	x	x	x	x	6866534D28	MTP700 User Guide (German)
	x	x	x	x	6866534D29	MTP700 User Guide (French)
	x	x	x	x	6866534D30	MTP700 User Guide (Dutch)
	x	x	x	x	6866534D31	MTP700 User Guide (Spanish)
	x	x	x	x	6866534D32	MTP700 User Guide (Portuguese)
	x	x	x	x	6804112J75	MTP700 User Guide (Mandarin)

Note:

x Indicates one of each is required.

* For Asia, please use H415EK Option for Bulk Package.

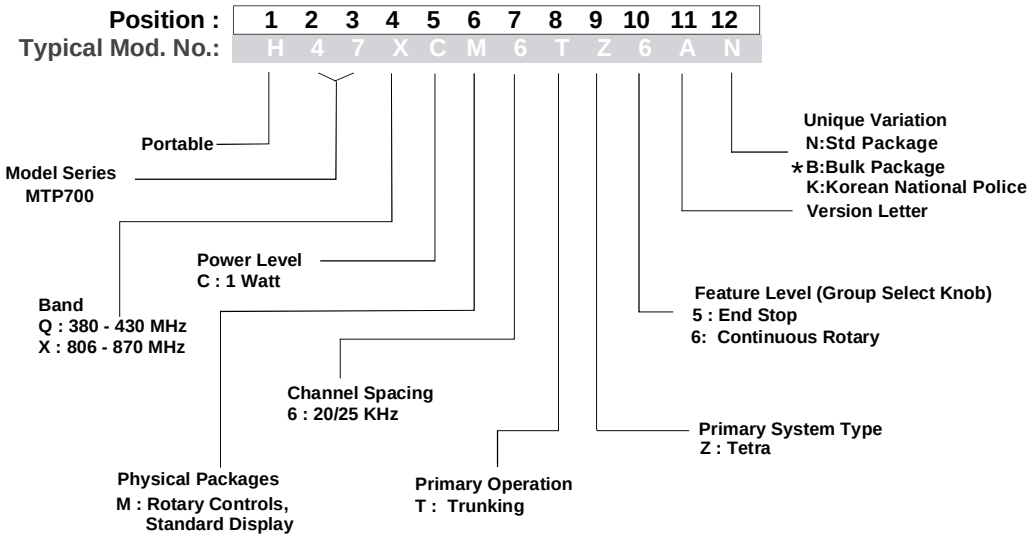
** For replacement kits, see Appendix A Replacement Parts and Kits.

*** Not Field Replaceable for Latin America

MTP700 Portable Radio Model Information

Model	Model Description
P1	MTP700, **380-430 MHz**, 1 W, 25 kHz, with **C**ontinuous **R**otary knob for group selection (CR)
P2	MTP700, **380-430 MHz**, 1 W, 25 kHz, with **E**nd **S**top knob for group selection (ES)
P3	MTP700, **806-870 MHz**, 1 W, 25 kHz, with **C**ontinuous **R**otary knob for group selection (CR)
P4	MTP700, **806-870 MHz**, 1 W, 25 kHz, with **E**nd **S**top knob for group selection (ES)
P5	MTP700, **806-870 MHz**, 1 W, 25 kHz, with **E**nd **S**top knob for group selection (ES), Korean model

Sales Model Nomenclature



* For Asia, please use H415EK Option for Bulk Package.

MTP700 Portable Radio Model Specification

GENERAL		RECEIVER		TRANSMITTER	
ETSI:	ETS 300 394-1	Receiver Type:	Class B	Modulation Type:	$\pi/4$ DQPSK
Type Number		Frequency Range:		Nomin. Output Power:	
- 380-430 MHz:	PT911E	- TMO:	380-430 MHz	- TMO	30 dBm
- 806-870 MHz:	PT711E		851-870 MHz	- DMO	30 dBm
				Frequency Range:	
		- DMO:	380-430 MHz	- TMO:	380-430 MHz
			851-870 MHz		806-825 MHz
				- DMO:	380-430 MHz
					851-870 MHz
Temperature:		Channel Spacing:	25 kHz	Channel Spacing:	25 kHz
- Operating Temp.:	-30... +60°C (except LiIon battery & LCD display: -20°C)	Sensitivity (4%) BER:	-112 dBm (minimum)		
- Storage Temp.:	-40... +85°C				
Battery chemistries:	LiIon or NiMh	Intermodulation:	-47 dBm	Spurious Emission:	-36 dBm
Battery capacity:				Adjacent Channel	-55 dBc
- with standard LiIon:	1200 mAh	Blocking:		Power (at ± 25 kHz)	(UHF)
- with NiMh:	1200 mAh	- at 1, 2, 5 & 10 MHz	-25 dBm		
		- Adjacent channel selectivity @ 25 kHz	-60 dBm		
Battery autonomy 5/5/90 (TX/RX/Stdby):				Spurious Rejection:	-45 dBm
				Frequency Stability:	
- with standard LiIon or NiMh	24 hours*			- TMO	± 100 Hz relative to downlink carrier frequency
				- DMO	±1 kHz
Battery autonomy 5/35/60 (TX/RX/Stdby):		Audio Rated:	500 mWatt		
		Distortion:	< 5 %		
- with standard LiIon or NiMh	15 hours*				
Dimensions (HxWxD) mm:	138x55x39				
Weight:					
- with standard LiIon battery	361 g				
- with standard NiMh battery	434 g				

* at medium audio power level

Table 2-1 Model Specification

MTP700 Accessories-To-Model Chart

MTP700 PORTABLE RADIO ACCESSORIES		380-430 MHz		806-870 MHz		
Batteries - Smart	**Kit Number**	**P1**	**P2**	**P3**	**P4**	**P5**
Battery, LiIon, Std, 1200 mAh	PMNN4047_	x	x	x	x	x
Battery, NiMH, 1200 mAh	PMNN4048_	x	x	x	x	
Battery, NiMh, FM, 1150 mAh	PMNN4049_	x	x	x	x	
Antennae	**Kit Number**	**P1**	**P2**	**P3**	**P4**	**P5**
806-870 MHz, Whip	NAF5037_			x	x	
806-870 MHz, Stubby	NAF5042_R			x	x	x
380-400 MHz, Narrow band	FAE6000_	x	x			
410-430 MHz, Narrow band	FAE6001_	x	x			
380-400 MHz, Whip	FAE5520_	X	X			
410-430 MHz, Whip	FAE6002_	x	x			
Chargers	**Kit Number**	**P1**	**P2**	**P3**	**P4**	**P5**
IMPRES Multi Unit Charger (MUC) with 230V Euro Plug	WPLN4109_	x	x	x	x	
IMPRES Multi Unit Charger (MUC) with 230V UK Plug	WPLN4110_	x	x	x	x	
IMPRES Multi Unit Charger (MUC) with 120V USA Plug	WPLN4120_	x	x	x	x	
Battery Insert (all MUCs need this battery adapter)	RLN5212_	x	x	x	x	
110V Single Unit Charger (SUC) Smart Charger	WPLN4111_R	x	x	x	x	
IMPRES Single Unit Charger (SUC) with Euro Plug	WPLN4112_	x	x	x	x	
IMPRES Single Unit Charger (SUC) with UK Plug	WPLN4113_	x	x	x	x	
IMPRES Single Unit Charger (SUC) with AUST/ NZ Plug	WPLN4115_	x	x	x	x	
IMPRES Single Unit Charger (SUC) with Argentina Plug	WPLN4116_	x	x	x	x	
Single Unit Adaptive Charger (SUC) with US/NA Plug	WPLN4117_R	x	x	x	x	
Battery Insert (all SUCs need this battery adapter)	RLN5211_	x	x	x	x	
Rapid Charger, Non-Smart, US Plug 2-Pin*	PMTN4063_	x	x	x	x	
Rapid Charger, Non-Smart, Euro Plug 2-Pin*	PMTN4064_	x	x	x	x	
Rapid Charger, Non-Smart, UK Plug 3-Pin*	PMTN4065_	x	x	x	x	
Charger Base only - Non-Smart*	PMLN4522_	x	x	x	x	x

Table 2-2 Accessories

MTP700 PORTABLE RADIO ACCESSORIES		380-430 MHz		806-870 MHz		
Carrying Case Accessories	**Kit Number**	**P1**	**P2**	**P3**	**P4**	**P5**
Hard leather case with Swivel	PMLN4474_	x	x	x	x	x
Carrying strap for above	NTN5243_	x	x	x	x	x
2.5 inch belt clip	HLN9714_	x	x	x	x	x
Light leather case ("GSM" style)	PMLN4475_	x	x	x	x	
Wrist strap	HLN9767_	x	x	x	x	x
Nylon Case	RLN4851_	x	x	x	x	
Large Shoulder Harness Kit	GMLN4093_	x	x	x	x	
Small Shoulder Harness Kit	GMLN1051_	x	x	x	x	
AUDIO - REMOTE SPEAKER / MICROPHONE (RSM)	**Kit Number**	**P1**	**P2**	**P3**	**P4**	**P5**
Enhanced Remote Speaker/Microphone (ERSM), terminates with side connector, emergency button, programmable button, manual volume control, earpiece jack, vibrator alert	RMN5011_ (Short - 35 cm) RMN5012_ (Long - 70 cm)	x x	x x	x x	x x	x
Short Coil Cord (35 cm)	RLN5258_	x	x	x	x	
Long Coil Cord (70 cm)	RLN5259_	x	x	x	x	
Remote Speaker/Microphone (RSM), with 3.5 mm threaded jack	RMN5013_	x	x	x	x	
Receive only earbud, black coiled cord (plugs into 3.5 mm jack on RSM)	RLN4885_	x	x	x	x	
Programming Equipment	**Kit Number**	**P1**	**P2**	**P3**	**P4**	**P5**
Data Cable	PMLN4504_	x	x	x	x	x
Programming/Data Cable	FLN9636_	x	x	x	x	x
Programming Stand	PMLN4510_	x	x	x	x	x
MTP700 Customer Programming Software (CPS)	FVN5051_	x	x	x	x	x
Audio Surveillance	**Kit Number**	**P1**	**P2**	**P3**	**P4**	**P5**
Rx Only Earpiece - Black	RMN4028_	x	x	x	x	
Rx Only Earpiece - Beige	RMN4021_	x	x	x	x	
Rx Only Earpiece -with transparent tube for RSM	RLN4941_	x	x	x	x	
Earpiece with mic and PTT combined, beige, 2 wire	RMN4022_	x	x	x	x	x
Earpiece with mic and PTT combined, black, 2 wire	RMN4029_	x	x	x	x	
Earpiece with separate mic and PTT, beige, 3 wire	ENMN4017_	x	x	x	x	x
Earpiece with separate mic and PTT, black, 3 wire	ENMN4014_	x	x	x	x	
Earplugs Foam w/Acoustic Tube	NTN8370_	x	x	x	x	
Rubber Eartips w/Acoustic Tube	NTN8371_	x	x	x	x	
Noise Attenuating Plugs	5080384F72	x	x	x	x	
Large Earshell (offered in EMEA)	WADN4223_	x	x	x	x	
Small Earshell (offered in EMEA)	WADN4224_	x	x	x	x	
Audio - Headsets	**Kit Number**	**P1**	**P2**	**P3**	**P4**	**P5**
Lightweight Headset with Swivel Boom Microphone & PTT	RMN5014_	x	x	x	x	
Breeze Headset, PTT	ENMN4012_	x	x	x	x	

Table 2-2 Accessories

* For Asia only.

CHAPTER 3
OVERVIEW

General

The MTP700 is Motorola's latest and most advanced digital portable TETRA radio. This radio generation is based on a new digital platform technology. It covers Trunk Mode Operation (TMO) as well as Direct Mode Operation (DMO) and among other new features it is supplied with extended code and operation memory capacity to support all new market requirements. The MTP700 TETRA radio ensures a high audio quality.

To achieve a high spectrum efficiency, the MTP700 units use digital modulation technology and sophisticated voice-compression algorithm. The voice of the person speaking into the microphone is converted into a digital bit stream consisting of zeros (0) and ones (1). This stream is then modulated into a radio-frequency (RF) signal, which is transmitted over the air to another unit. This process is called digital modulation.

Digital Modulation Technology

The MTP700 are 380-430 MHz or 806-870 MHz portable radios that can operate in dispatch mode. They use two digital technologies: $\Pi/4$ DQPSK and Time Division Multiple Access (TDMA).

$\Pi/4$ DQPSK is a modulation technique that transmits information by altering the phase of the radio frequency (RF) signal. Data is converted into complex symbols, which alter the RF signal and transmit the information. When the signal is received, the change in phase is converted back into symbols and then into the original data.

The TETRA system can accommodate 4-voice channels in the standard 25 kHz channel as used in the two-way radio.

Time Division Multiple Access (TDMA) is used to allocate portions of the RF signal by dividing time into four slots, one for each unit.

Time allocation enables each unit to transmit its voice information without interference from other transmitting units. Transmission from a unit or base station is accommodated in time-slot lengths of 14 milliseconds and frame lengths of 57 milliseconds. The TDMA technique requires sophisticated algorithms and voice compressions/decompressions (perform by digital-signal processor, DSP) and RF modulation/demodulation.

Voice Compression Technology

Voice is converted into a digital bit stream by sampling the voice at a high rate and converting the samples into numbers, which are represented by bits.

Voice compression reduces the number of bits per second while maintaining the voice at an acceptable quality level. The TETRA system uses a coding technique called ACELP (Algebraic Code Excited Linear Prediction). The compressed voice-data bits modulate the RF signal.

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CHAPTER 4
RADIO INFORMATION

Section Introduction

This section provides a block diagram overview of the main Digital/RF Board supplemented by the detailed block diagram and detailed circuit description followed by board and schematic diagrams and parts lists and troubleshooting charts.

This chapter contains the following sections:

4.1 Transceiver 380-430 MHz

4.2 Transceiver 806-870 MHz

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CHAPTER 4.1
TRANSCEIVER 400 MHz

General

This section provides a block diagram overview of the main Digital/RF Board. This is supplemented by the detailed block diagram and detailed circuit description.

Block Diagram Overview

The main Digital/RF Block contains the following four sections (see Figure 4.1-1). An overview of these four sections is provided in the following paragraphs:

- Receiver Section
- Transmitter Section
- Frequency Generating Section (Synthesizer)
- Digital & Audio Section

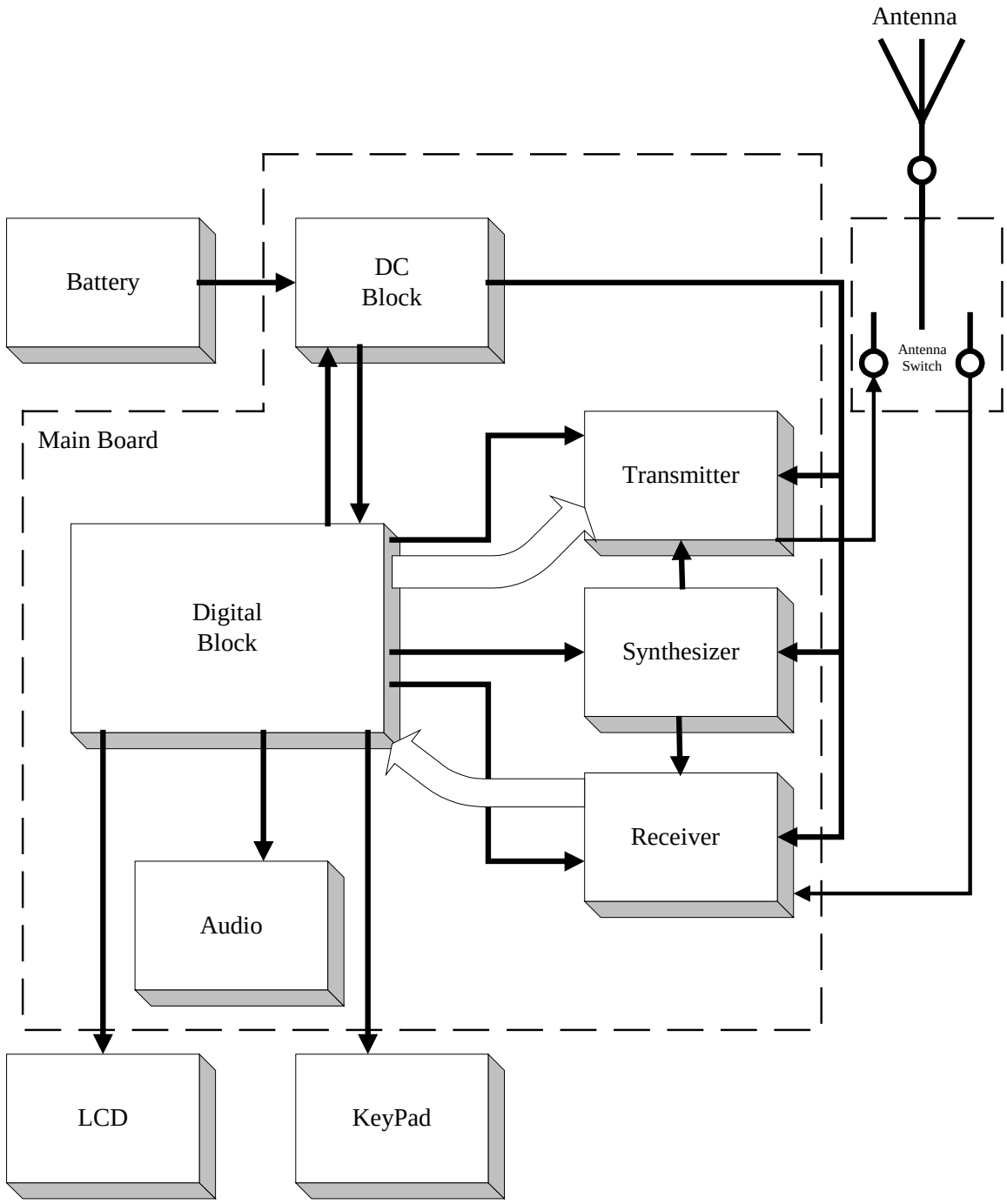


Figure 4.1-1 General Block Diagram

Receiver Section

The receiver section includes the following main components:

- Antenna Switch
- Limiter
- Pre-selection Filter
- Low Noise Amplifier (LNA)
- Post-selection Filter
- Mixer
- IF Filter
- Balun
- WPIC

The Receiver Path implements an Automatic Gain Control (AGC). It is required to maintain good receiver linearity over a wide range of incoming signals and to prevent clipping of high level signals.

The First Intermediate frequency (IF) circuit consists of the Mixer, IF Filter, and WPIC. The First IF is down converted to baseband using an analog mixer (high-side injection) located in the WPIC. An external second LO synthesizer IC is used to generate the required 219.3 MHz signal, which is further divided by two to 109.65 MHz before being applied to the mixer.

The WPIC performs the following functions:

- Carries out amplification and quadrature down conversion of the signal into baseband.
- Performs IF AGC.
- Converts the baseband analog signal into digital I & Q formats.
- Synthesizes the receive and transmit data (i.e. Sigma-Delta) clock.
- Transmits the received data to the DSP.

Transmitter Section

The transmitter circuitry includes a linear class AB Power Amplifier (PA) for the linear modulation of the MTP700. Also included is a cartesian feedback loop to enhance the transmitter linearity and hence reducing splattering in the adjacent channels.

The transmitter path consists of forward and feedback paths. The forward path includes the WPIC for digital-to-analog conversion of the transmit baseband signal, the LNODCT (Low Noise Offset Direct Conversion Transmitter) IC, Balun, Attenuator and Power Amplifier. The feedback path includes the directional coupler, attenuator and LNODCT (Low Noise Offset Direct Conversion Transmitter) IC.

The linearized power from the PA goes through the isolator which provides the isolation between the antenna and the PA. The signal then passes through the antenna switch and a lowpass Harmonic Filter to provide additional filtering to remove far out unwanted signals.

Frequency Generating Section (Synthesizer)

The frequency generating section contains the following components:

- TCXO Reference Oscillator.
- Main Synthesizer - consists of the WPIC's PLL and the Main Voltage Controlled Oscillator (VCO).
- 2nd Local Oscillator (LO) VCO together with the LMX Dual Synthesizer IC.
- Transmit PLL - consists of TX VCO together with ESCORT Synthesizer IC.

Digital & Audio Section

The digital section includes the RedCap2 host micro-processor which is the controller of the Digital/RF Board. It controls the operation of the audio and transmitter, receiver, and synthesizer integrated circuits located in the RF section. It has the serial communication interface to communicate with the keypad, display and other internal peripherals.

For audio, the RedCap2 contains a Digital Signal Processor (DSP) which performs modulation and de-modulation functions for the radio. It also performs ACELP speech coding and Forward Error Correction.

Major components of the digital section are:

- RedCap2 (microprocessor with DSP embedded)
- GCAP3 (DC power supply and audio amplifier circuits)
- Serial peripheral interface (SPI)
- External host memories (Flash and SRAM)
- Keypad block & circuits
- LCD (liquid-crystal display) circuits
- Bottom connector & side connector interface circuits

Block Diagrams Descriptions

The block diagrams descriptions cover Receiver Path, Transmitter Path, Frequency Generation Section and Digital Section.

Receiver Path

The received signal (see Figure 4.1-2) from the antenna is directed by the Antenna Switch to the Pre-selection Filter.

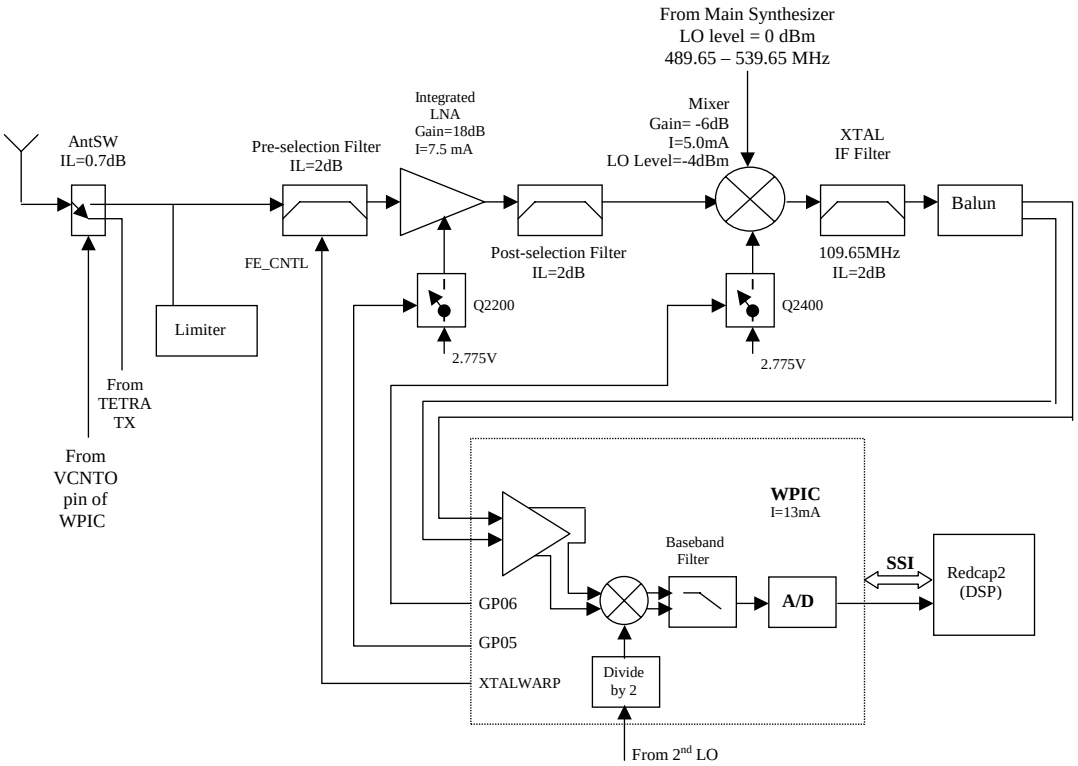


Figure 4.1-2 Receive Path - Block Diagram

The Pre-selection Filter blocks the half IF and image frequencies and reduces the RF oscillator leakage to the antenna. The mid-frequency of this front filter is tuneable in five steps to achieve the required selectivity for the entire receive frequency range 380-430MHz. Additional selectivity is provided by a fixed-tuned Post-selection Filter. The filtered signal is mixed (at high side) with the signal of the Main Synthesizer to create the first IF at 109.65 MHz. The IF signal is filtered by the crystal filter and sent to the WPIC.

The WPIC performs down conversion to the baseband frequency (0 Hz). The baseband analog signals are converted to digital In-phase (I) and Quadrature (Q) formats. This data is sent for further processing to the Digital Signal Processor (DSP) (part of RedCap2) over the Synchronous Serial Interface (SSI) data links.

The DSP performs: the demodulation, Forward Error Correction (FEC) and other correction algorithms for overcoming channel errors, and decoder procedure for digital speech data decompression.

Transmitter Path

When the radio is transmitting (see Figure 4.1-3), the microphone audio is sent to the GCAP3 (CODEC). The CODEC performs 13-bit analog-to-digital conversion and the digital signal is routed to the DSP (part of RedCap2). The DSP performs coding, Error Correction and modulation. From the DSP, the digital base band signal is sent to the WPIC.

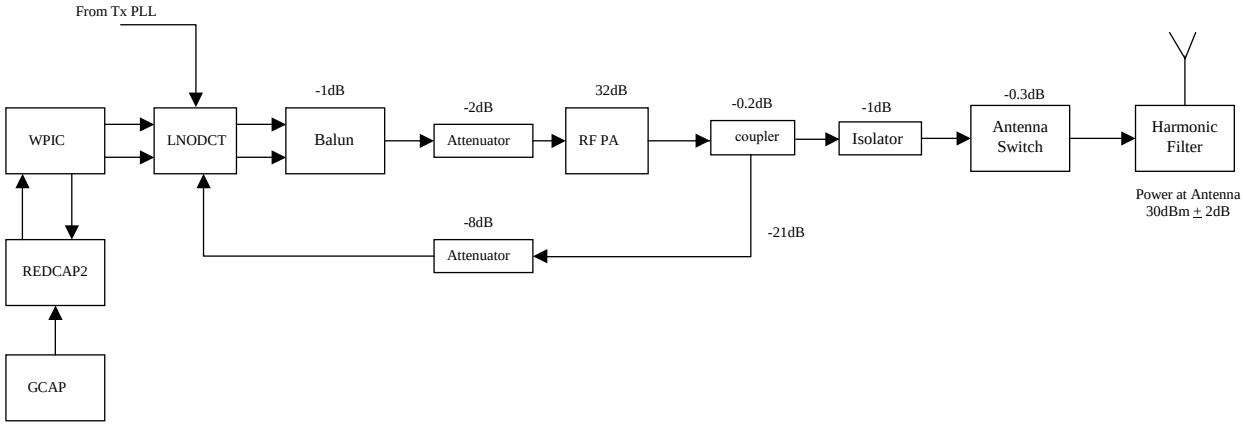


Figure 4.1-3 Transmit Path - Block Diagram

In the WPIC, the digital baseband I & Q signals are converted into corresponding analog signals. These signals are also filtered. From the WPIC, I & Q signals are injected to the LNODCT. In the LNODCT, the data is mixed with RF signal.

From the differential output of the LNODCT, the modulated RF signal is injected to the Balun wideband transformer that transforms the differential input into single output, and then it is routed to the antenna via TX PA, Isolator, Antenna Switch and Harmonic Filter.

The feedback signal is used for power control.

Frequency Generating Section

The frequency generating section contains the following components (see Figure 4.1-4):

- TCXO Reference Oscillator.
- Main Synthesizer - consists of the WPIC's PLL and the Main Voltage Controlled Oscillator (VCO).
- 2nd Local Oscillator (LO) VCO together with the LMX Dual Synthesizer IC.
- Transmit PLL - consists of TX VCO together with ESCORT Synthesizer IC.

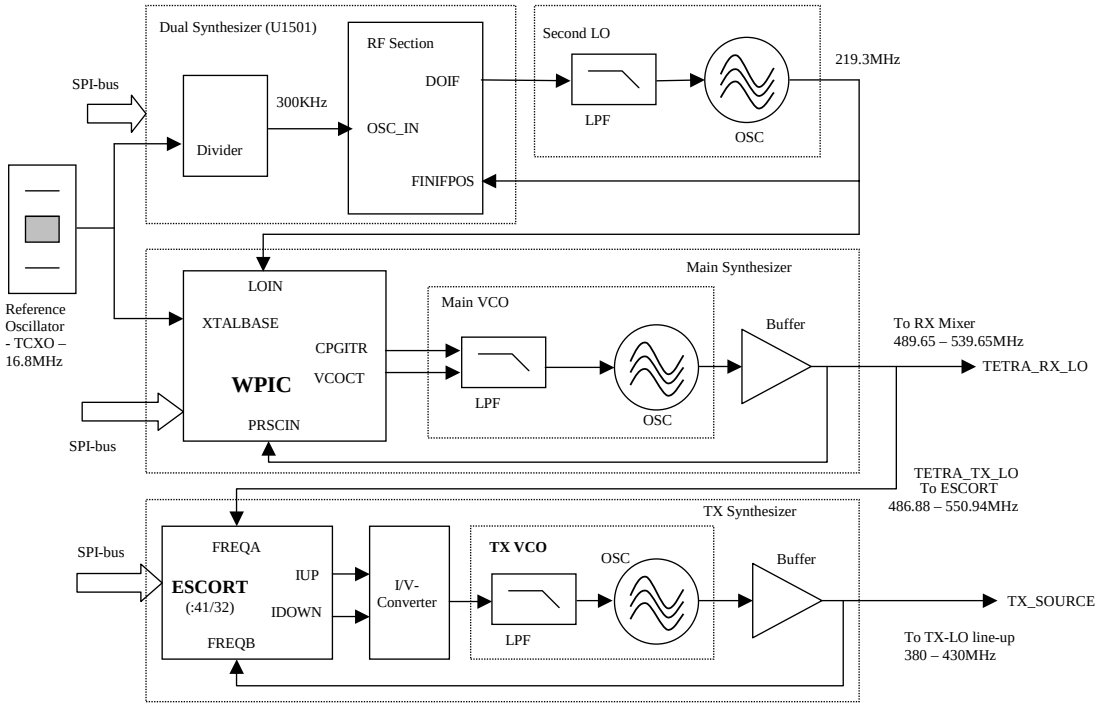


Figure 4.1-4 Frequency Generation - Block Diagram

TCXO Reference Oscillator

All frequencies originate from the Reference oscillator - TCXO. This is a digital temperature compensated crystal oscillator producing an accurate and stable 16.8 MHz reference frequency. The 16.8 MHz reference frequency is divided in the WPIC and in the Dual Synthesizer IC to produce required reference frequency for the other synthesizers.

Main Synthesizer

The Main Synthesizer consists of the WPIC internal PLL modules and an external, discrete Voltage Controlled Oscillator (VCO) . The output provides the LO signal to down-convert the received RF signal to the first IF of 109.65 MHz. The output is also routed as the transmit injection frequency for the ESCORT IC.

RX Second Local Oscillator (LO)

The second LO synthesizer supplies the second IF local oscillator signal to the receiver. The signal of the frequency of 219.3 MHz will be used in the WPIC to generate the quadrature signals for downconverting the received IF signal to the baseband (zero IF).

Transmit PLL

The TX PLL consists of a discrete TX Voltage Controlled Oscillator (TX VCO) and the ESCORT Synthesizer IC. The ESCORT IC receives its reference signal (TETRA_TX_LO) from the main synthesizer/VCO to synthesize the TX VCO signal within the frequency range of 380-430 MHz, which is subsequently routed to the transmitter path (LNODCT).

Digital & Audio Section

The digital section (see Figure 4.1-5) contains the radio's RedCap2 RISC processor, DSP (embedded within), external memories and GCAP3. The DSP has its own processing memory. GCAP3 contains switching and linear regulators, audio preamplifiers, 13-bit CODEC, A/D and D/A Converters, and interfaces with an external Audio Amplifier for receive audio.

RedCap2 controls the receive/transmit frequencies, power levels, display, keypad, accessories, MMI, and other radio functions. This microprocessor can be operated through the RS232 interface by a personal computer to program the Flash memory with firmware and codeplug.

The DSP performs the functions of audio filtering, ACELP speech coding, Forward Error Correction and digital modulation. The GCAP3's CODEC handles the analog-to-digital and digital-to-analog conversions on audio signals.

The power distribution is supported by the Global Control Audio Power (GCAP3) IC. This IC supplies power to the radio using step-down PWM regulator supplying 1.875 VDC to the RedCap2 core, supplying V3 linear regulator 2.775VDC to the external memories, display and RedCap2 peripheral modules, supplying V2 to GCAP3 internal logic, internal audio amplifier and A/D converter. The regulator's power-down mode is controlled by the RedCap2, which senses the ON or OFF condition.

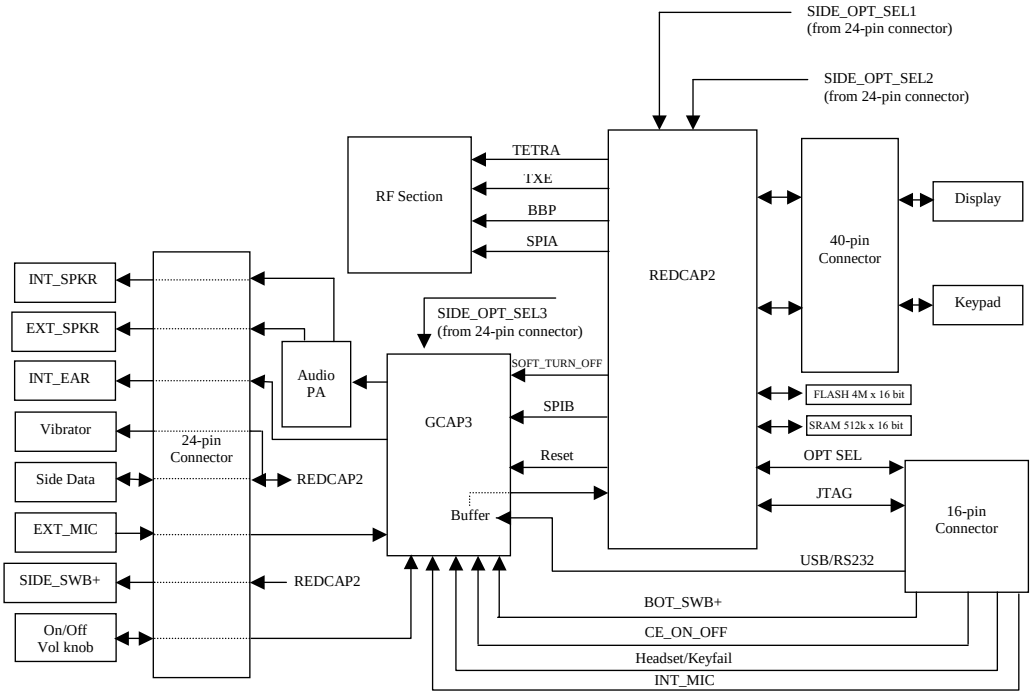


Figure 4.1-5 Digital Section - Block Diagram

Detailed Circuit Description

Receiver Path, Detailed Circuit Description

See Figure 4.1-6.

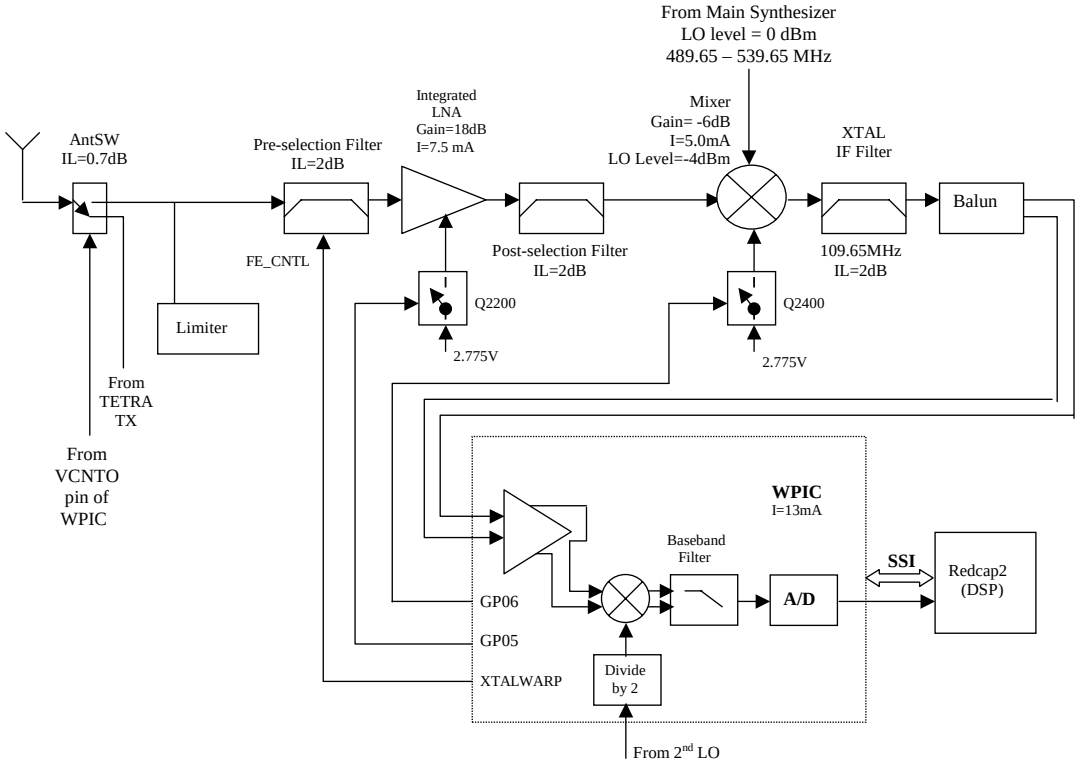


Figure 4.1-6 Receive Path Circuit Diagram

Antenna Switch

The signal from the antenna is routed to the receiver input via the transmitter harmonic filter (C5016, L5008, C5015 and C5011), an equivalent quarter wave line (L5007 with C5011 and C5020) and the low pass (C5020, L5011, C5022 and C5021) for spurious response improvement. Isolation to transmitter frequencies at this point is better than 35dB; attenuation of the wanted Rx signal is typically 0.7dB.

Limiter

Diode D2100 limits the level of incoming high power signals (> 5dBm) to prevent damage to the receiver front end.

Pre-selector

The signal arriving at the receiver input is routed through the integrated, tuneable Pre-selector Filter FL2100 into the Low Noise Amplifier (LNA) U2200 via a matching network C2200, L2200, R2200 and C2201.

The pre-selector attenuates unwanted incoming RF signals, especially the image frequency (25dB). Typically, the insertion loss is 2dB.

Low Noise Amplifier (LNA)

The LNA U2200 amplifies the RF signal. The overall gain of the LNA including the output matching circuit, L2201, R2202, C2209, C2210 and L2202 typically is 18dB. Because the LNA is the first amplifier in the RX line, it is important that it provides high gain and has a low noise figure.

The LNA has an “enable” pin (pin 3) which is called VPD. When this pin receives a signal of 2.7V from DC switch Q2200 the amplifier is enabled (via signal GP05_DCLICP from WPIC). In the transmit slot, Q2200 is switched off. The LNA current is controlled by R2201. Resistor R2202 ensures the amplifier is stable throughout its operating range. From the LNA, the signal passes to the fixed-tuned post-selector.

Post-selector

The Post-selector, consisting of discrete components C2300-C2306, L2300-L2302, attenuates the non-linear products of the LNA and also the image product. Typically, its insertion loss is 2dB. From the output of the post-selection filter, the received signal is routed to the mixer RF input via attenuator R2404-R2406 and band pass L2402, C2402.

Mixer

The mixer U2400 down-converts (at high side) the incoming RF signal to an IF signal (109.65 MHz). The mixer IC consists of a mixer and an LO buffer amplifier.

The RF signal enters the mixer at pin 1, and the IF is produced at pin 6. The LO signal from the main synthesizer passes via the attenuator R2400-R2402 and the wide band matching network L2400, C2400, R2403, C2401 into the IC at pin 3. The LO power is boosted internally before being applied to the mixer. The LO signal power at the LO mixer input is -4dBm. The 2.7V DC is supplied by switch Q2400, that is enabled during receive mode (via signal GP06_DCLICIN from WPIC).

The mixer conversion gain is -6 dB.

An impedance matching network is placed between the mixer and the IF filter FL2500. It consists of C2405, L2403, C2500, L2500 and C2501.

IF Filter

The IF signal is routed via the IF filter (FL2500), which has an insertion loss of 2 dB and attenuates unwanted mixing products of the mixer. It is connected via a matching network, consisting of C2502, L2501 and C2503, to the balun network.

Balun

The balun network (L2502, C2505, C2504 and L2503) transforms the single-ended input RF signal to a differential double-ended output.

The differential signal is routed to the WPIC, pins A4 and B4, via C1018 and C1019.

WPIC (Receiver Back End Section)

The differential IF signal is amplified and converted down to zero IF inside the WPIC (World Phone IC) by the 2nd LO signal. The 2nd LO signal is routed to the WPIC at pin D1 and divided by two into the quadrature generator block of the WPIC. The baseband signal from this 2nd mixer passes to an amplifier baseband filter array. The amplified and filtered signal is passed to the WPIC A/D converter. This A/D converter digitises the analog differential signal into its I and Q components. The I and Q components appear in sequence on the WPIC_SRD line whenever the RX_ACQ line is high. The WPIC_SRD data is clocked into the DSP using a clock signal (WPIC_TXCLK) from WPIC. The WPIC is controlled via SPIA_MOSI, SPIA_CLK and SPIA_CSO_WPIC from RedCap2.

An internal AGC that is controlled by a control unit, establishes an appropriate attenuation for unwanted signals as well as an appropriate gain for wanted signals. The voltage at external capacitor C1008 indicates the AGC attenuation level for the different input signal levels. The voltage at the capacitor varies from 1.4V to 2.7V as a function of the power of the received signal.

Transmitter Path, Detailed Circuit Description

See Figure 4.1-7.

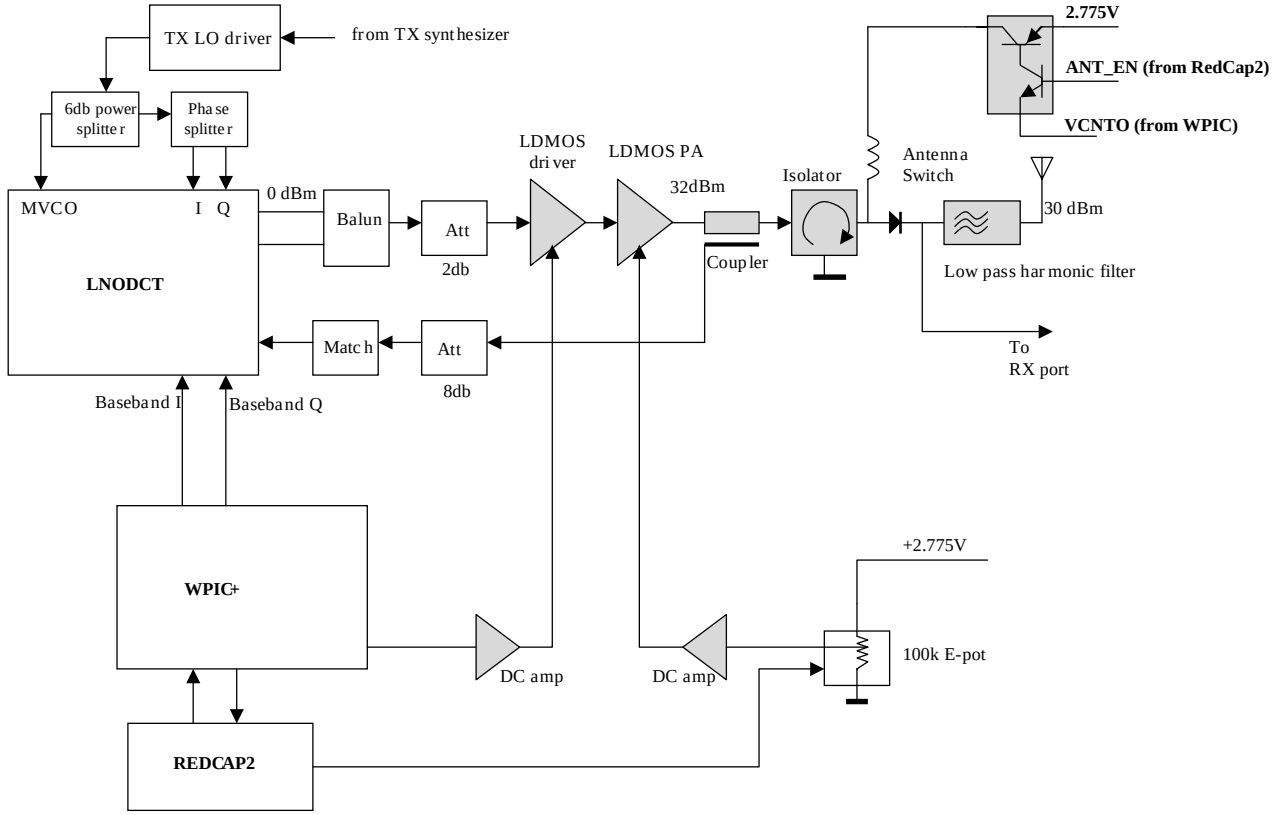


Figure 4.1-7 Transmit Path - Circuit Diagram

Forward Path

WPIC

The WPIC (World Phone IC) U1001 receives serial data that is transmitted by the RedCap2 at 48 ksps (kilosamples/second) to the SSI port (pin K10, WPIC_STD). Data is transmitted as a 16-bit 'I' word followed by a 16-bit 'Q' word. The WPIC provides a serial clock of 4.8MHz to the RedCap2 (pin K11, WPIC_TXCLK) and sends a frame sync signal (pin L11, WPIC_FSYNC) at the beginning of every 'I' word transmission to instruct the RedCap2 to send data. In the WPIC, the received serial I & Q words from the RedCap2 are converted into parallel I & Q words, and transferred to an interpolating filter. The interpolating filter increases the sampling rate to reduce in-band quantization noise, as well as to reduce image at multiples of the input data. The interpolated samples are rounded to 8 bits, and run through the 8-bit D/A converters. The D/A converters take the digital I & Q words and convert them into analog signals, which are then filtered and amplified. The output is comprised of two separate low-level differential signals, I & Q (pins A8, OUTQ; C8, OUTQB; D8, OUTI; A9, OUTIB). A differential output is used to minimize the noise pick-up, due to its inherent common mode rejection.

The output signals are routed to the LNODCT IC. The WPIC sends a 2.4MHz low-level differential reference clock signal (pins B11, TCLK; C10, TCLKB) to the LNODCT. It also sends a differential signal (pins A11, TSLOT; A10, TSLOTB) that marks the beginning and the end of each transmission time slot (whenever pin 8, WPIC_TXE signal is received from RedCap2). After receiving the TSLOT signal, the LNOCDT toggles the ASW line (pin J5) which signals the WPIC to set VCNTO signal LOW (pin J6) which enables the Antenna Switch during transmit time.

TX LO Line-Up

The TX frequency signal TX_SOURCE is generated in the TX PLL of the Frequency Generating Section. This signal passes an attenuator R6001-R6003, the LO driver Q6001 and a band pass filter (C6006-C6012, L6003, L6004) to attenuate unwanted spurious frequencies. The signal level is about +7dBm. This is then split by a simple, resistive 6dB power splitter consisting of R6008, R6009 and R6010.

One output of the power splitter drives phase splitter U6001 that converts the single input signal into two quadrature (90 degrees phase shift) ‘I’ and ’Q’ signals and then routes them to the LO input (LOI, LOIB, LOQ, LOQB) of the LNODCT.

The second output of the power splitter U6001 is applied to the LNODCT LO feedback input (MVCO).

LNODCT

The LNODCT IC (Low Noise Offset Direct Conversion Transmit IC) U6002 is the heart of the transmitter.

The differential baseband signals from WPIC are applied to the LNODCT on pins 58 – 61 (BINQB, BINQ, BINIB and BINI). They pass through a variable attenuator and then they are summed with the down converted I & Q feedback. The baseband signal is then amplified and sent to the up-mixer.

The up-mixer consists of two mixers, one for the I channel and the other for the Q channel. The split I & Q LO signal is mixed with the baseband I & Q signals to produce I & Q modulated signals at RF frequency. The signals then are output differentially on pins 51 and 52 (RFOUTB, RFOUT).

Balun

The differential RF signal is converted to a single-ended (unbalanced) signal by passing the Balun (**bal**anced-**un**balanced) wide band transformer T6001. The Balun has a 200 Ohm balanced input and 50 Ohm single-ended output, set by C6032 and C6053 respectively. This Balun configuration matches the LNODCT differential output for optimum performance in the 380-430MHz frequency range. The insertion loss of the Balun is about 1dB.

Resistors R6024–R6026 form an attenuator to compensate for changes in gain in the forward path RF PA stages.

RF Power Amplifier

The signal is routed through coupling capacitor C6034 to the RF power amplifier (PA). The PA consists of 2 devices, namely U4001 driver and Q4001 final PA. U4001 is a 2-stage IC that is capable of amplifying the signal to about 18dBm . The capacitors and inductors between U4001 output and Q4001 input form a high pass - low pass matching network. Q4001 output is then matched to the 50 ohms input of the isolator by a low pass pi matching stage using microstrip-lines and discrete components.

Wideband RF stability of the PA is optimised by insertion of RF losses (R4008, R4006, R4004) in the gate circuit of Q4001.

The U4001 amplifier gain is set in the factory using the VBLIN signal (from WPIC). VBLIN is amplified by DC amplifier U4002. The voltage output from U4002 sets the quiescent current and hence the gain of the LDMOS driver IC U4001.

The gain of Q4001 is set in factory through serial SPI commands (from RedCap2) to the E-pot IC U4102. The output voltage of the E-pot is dependent on the internal resistance divider ratio and amplified by DC amplifier U4100. During transmission, the 2.775V supply to the E-pot is enabled using the signal PA_BIAS (from RedCap2). When this line signal is 2.775V (HIGH), the voltage to bias the final stage device is enabled.

Coupler and Feedback Path

The output signal from the RF PA passes through directional coupler U5001 to the Isolator FL5001. The sampled signal from the coupler provides feedback for linearization and power control. The sampled signal is routed via attenuator R5001, R5002, R5003 to the LNODCT (pins 37, RFIN; 36, RFINB). The feedback signal is routed back to LNODCT and mixed down to baseband in a quadrature mixer, amplified and summed with the baseband input signal.

Isolator

The signal in the forward path is fed to pin 4 of the isolator FL5001. The isolator is placed at the PA output to decrease the influence of antenna impedance variation on the PA performance. The reflected power from the antenna is absorbed in a 50-Ohm resistor inside the isolator. The isolator also protects the Cartesian loop from sudden VSWR variations that could lead to loop instability.

Antenna Switch

PIN diodes D5001, D5002 and D5003 are used as antenna switches. These PIN diodes are turned on during the transmission time slot. The RF signal from the Isolator is applied to the PIN diodes D5001 and D5002. The RF signal is then routed through the harmonic filter (C5011, L5008, C5015 and C5016) to the antenna. D5003 provides the needed RX isolation during Transmission mode.

In the Receiving mode the PIN diodes are turned off, the input RF signal is directed to the receiver path via $\lambda/4$ quarterwave equivalent LC-circuit (C5011, L5007 and C5020) and a further low pass filter (C5020, L5011, C5022 and C5021).

The condition of the PIN diodes is controlled by the voltage switch Q5001 by applying the ANT_EN signal (from RedCap2) to the switch. The VCNTO signal (from WPIC) applied to the voltage switch Q5001 is set LOW during the Receiving and Transmission modes. The resistors R5006 and R5008 determine the DC current through the PIN diodes.

The RF output signal is disabled during the CLCH (Training) mode by setting the VCNTO signal HIGH thus providing low output power to the antenna during the training slot.

Harmonic Filter

From the antenna switch the signal is routed to a single-section LC filter, consisting of L5008, C5011, C5015 and C5016. The filter attenuates the harmonics of the transmitter signal and reduces leakage of the Rx LO signal.

Resistor R5014 provides a discharge path for any build-up of static electricity at the antenna.

Frequency Generating Section, Detailed Circuit Description

See Figure 4.1-8

This section describes the circuits that generate all the required frequencies for the required transmitter and receiver functions. These circuits are described as follows:

- TCXO REF. Oscillator.
- Main VCO and Main Synthesizer.
- Second LO VCO and Dual Synthesizer RF section.
- Transmit PLL - TX VCO with the ESCORT Synthesizer IC.

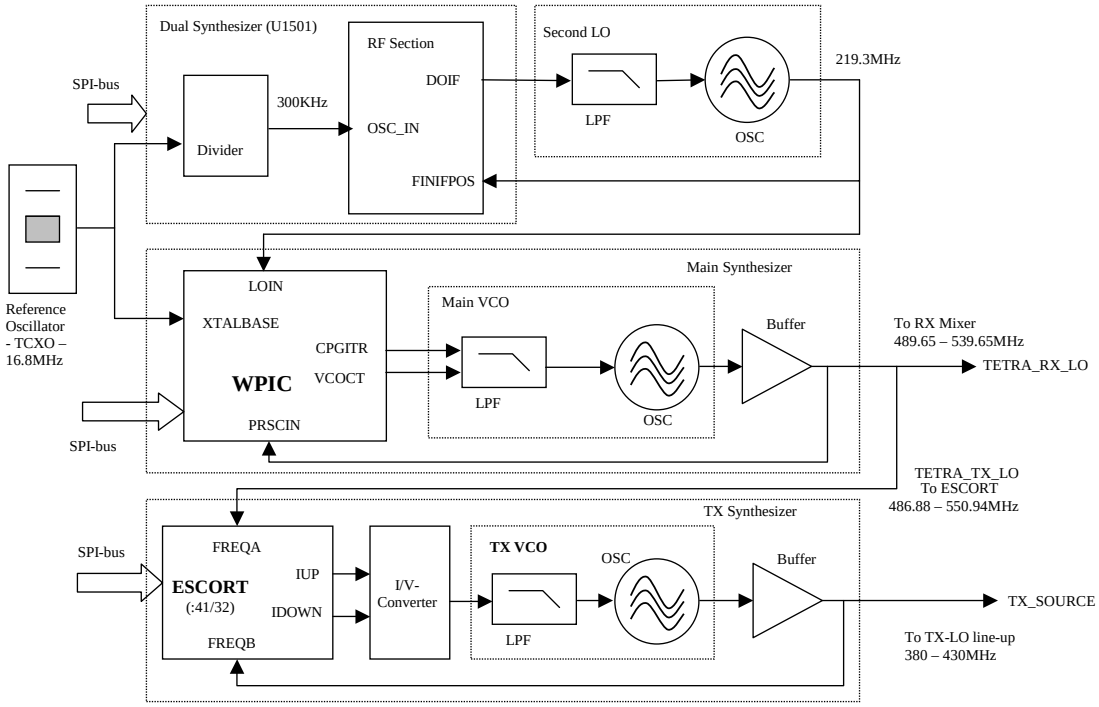


Figure 4.1-8 Frequency Generation Section - Block Diagram

TCXO Reference Oscillator

The TCXO oscillator Y1301 is the reference frequency source for all the radio synthesizers. The output of the oscillator is a 16.8 MHz stable temperature-compensated reference clock. This oscillator's centre frequency is adjustable by means of a PWM DAC (256 steps) to warp the radio frequency in order to lock to the base station. This 16.8 MHz signal from pin 3 of the TCXO is routed into the following devices:

1. To WPIC's K6 XTALBASE pin via C1301. The signal is divided by 4 to produce the 4.2 MHz reference signal, which is used for the Main Synthesizer PLL.

2. To LMX Dual Synthesizer's OSCIN pin via C1505. The signal is divided to produce the 300 kHz reference signal for the second LO PLL.

The reference signal is also routed from WPIC's pin F10 (16.8_MHz_CLK) to GCAP3 (and subsequently to RedCap2) to clock the digital circuits.

Main VCO and Main Synthesizer

The main synthesizer components are WPIC, Loop Filter, VCO and buffer. It produces the LO signal.

The synthesizer functions are as follows:

- To serve as the local oscillator for the mixer of the receiver. It is used to down-mix the RF frequency to the IF frequency 109.65 MHz
- To provide the reference signal for the ESCORT PLL IC of the Tx synthesizer.
- To provide as the WPIC feedback signal for locking the main synthesizer.

The WPIC is programmed by the DSP through the SPI bus.

The VCO (Q3002 and associated circuitry) generates the LO signal which is fed back to the synthesizer (inside the WPIC) through the PRSCIN. The TCXO provides the 16.8 MHz reference frequency.

The synthesizer then generates the VCTRL tuning voltage through WPIC's CPGITR pin to control the VCO frequency. The loop filter (LPF) consists of C1810, R1805, R1802 and C1816 which filters noise in the tuning voltage. A pre-setting of the VCO frequency is provided by additional tuning via the DC signals from the "Coarse Tune DAC" in the WPIC.

The Q3003 and Q3004 buffers prevent loading and interference to the next stage - i.e. the RX Mixer and ESCORT.

LMX - Dual Synthesizer

The U1501 (LMX233XL) is an integrated dual frequency synthesizer IC that includes prescalers. It is used with the second LO VCO at the RFCU section.

The LMX uses the 16.8 MHz from the TCXO for the second LO synthesizers and divides the TCXO frequency into 300 kHz reference frequency for the second LO.

Second LO VCO

The Second LO VCO is a discrete VCO (Q1521) that is controlled by the Dual Synthesizer IC (U1501). The VCO produces a frequency of 219.3 MHz that routes into LOIN pin of WPIC.

The output signal of the VCO is also routed via C1544 to the phase detector of Dual Synthesizer (pin 18, FINIFPOS). The internal phase detector is of the charge pump type.

The output signal of the phase detector is present at Dual Synthesizer (pin 20, DOIF) and then routed via the loop filter R1511, C1511 and C1512 to tuning diode D1521 of the tank circuit.

Transmit PLL

The TX VCO is a discrete VCO that is controlled by the ESCORT IC U7001. The VCO produces the TX frequency signals in the frequency band 380-430MHz. A discrete coil L7501 is used in the tank circuit of the VCO. Four tuning diodes (D7501-D7504) and the variable feedback by D7505 ensure excellent performance in noise behaviour and signal level stability throughout the whole band. A cascode amplifier is used as buffer to minimize the impact of load pull on the VCO frequency.

The synthesizer IC is the ESCORT IC U7001 employing NUD (near-unity-divider) technique to provide fast lock-in to TX frequency using a high reference frequency. The Main synthesizer is used as reference frequency source. The signal frequency of the Main VCO is divided by 41/32 and compared with the TX VCO frequency in the fast phase comparator of the ESCORT. The comparator output signals IUP and IDOWN then control the current mirrors Q7021 and Q7022 to supply the tuning voltage to low pass filter C7011, C7012, R7011 and voltage range extension transistors Q7023 and Q7024 to the tuning diodes. The ESCORT is controlled by the RedCap2 via SPIA_CLK; SPIA_MOSI and SPIA_CS1_ESCORT.

Digital & Audio Section, Detailed Circuit Description

See Figure 4.1-9.

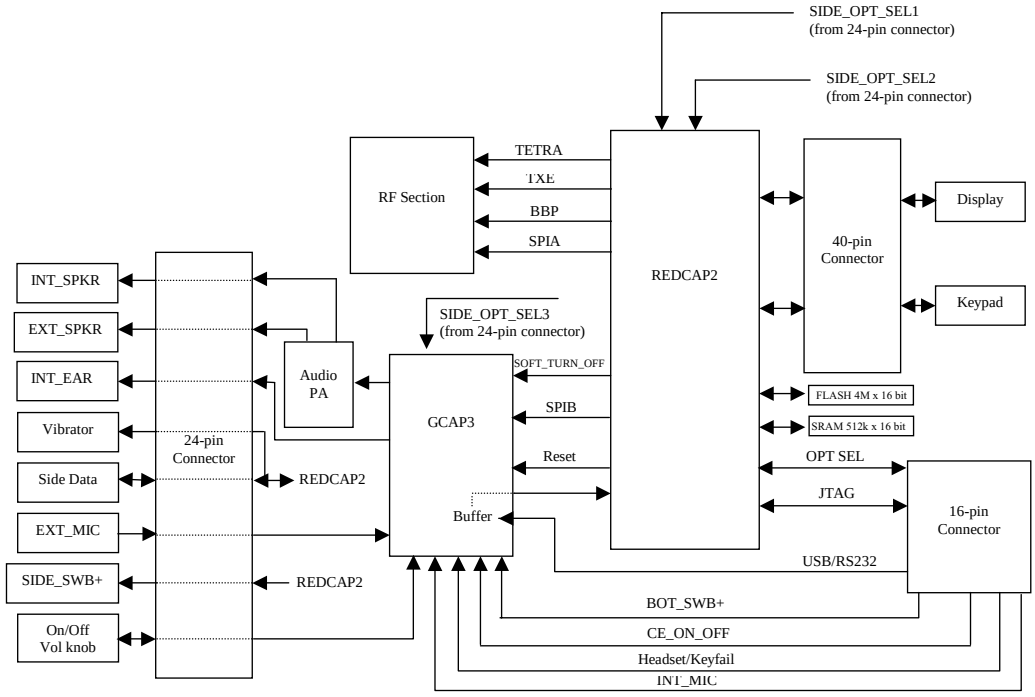


Figure 4.1-9 Digital Section - Detailed Circuit Diagram

RedCap2 (Microprocessor & DSP)

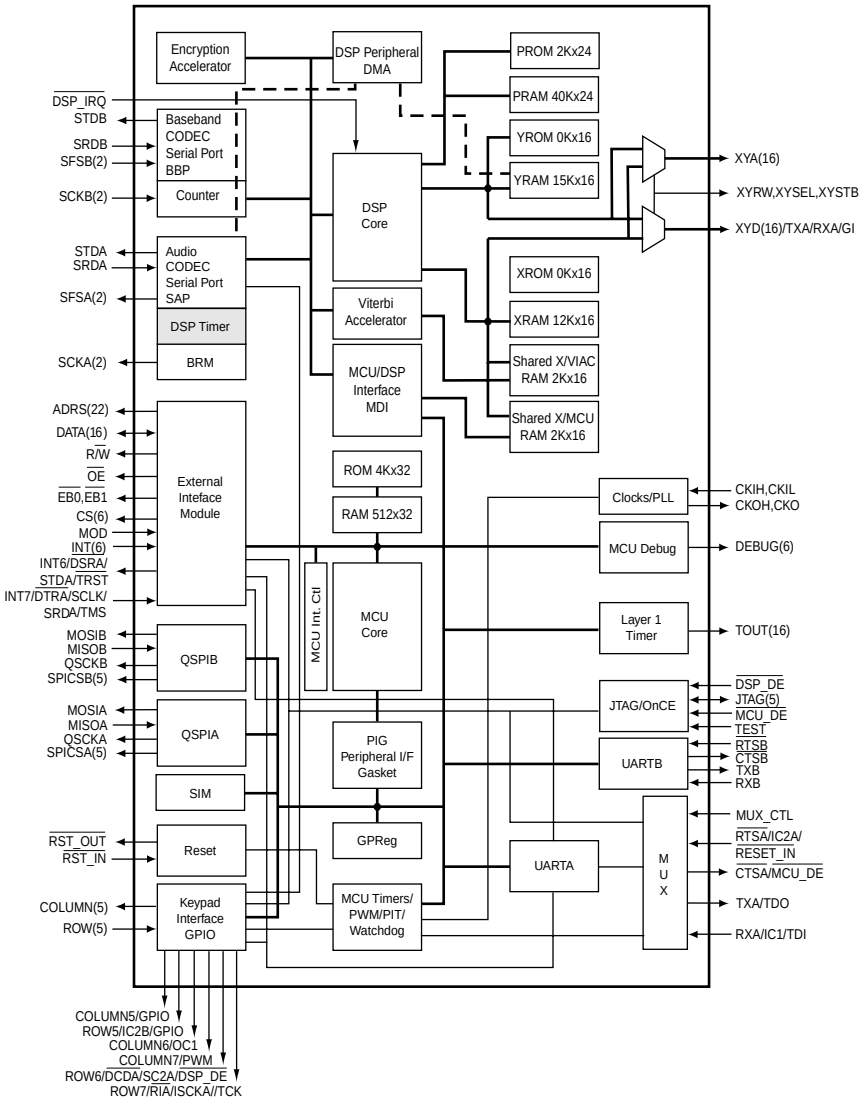


Figure 4.1-10 RedCap2 - Block Diagram

Figure 4.1-10 is a block diagram of the RedCap2 and its interfaces.

The RedCap2 RISC processor controls the operation of the transmitter, receiver, synthesizer and audio (GCAP3) integrated circuits. It uses the Flash memory and SRAM, both located externally.

RedCap2 employs SPI protocol (Serial Peripheral Interface) to communicate with the RF ICs, display, keypad and other internal peripherals. The processor can be operated through the RS232 interface by a personal computer to program the Flash memory with firmware and codeplug.

Within the RedCap2 is the Digital Signal Processor (DSP) which performs modulation and de-modulation functions for the radio. It also performs ACELP speech coding and Forward Error Correction.

External Host Memories

The RedCap2 Address bus is a 22-bit wide (0:21) and RedCap2 Data Bus is a 16-bit wide (0:15).

RedCap2 uses two types of memories:

Flash Memory

The Flash memory is dedicated to the application software. This memory has a 16-bit wide data bus. The Flash memory is 4 Meg x 16-bit (ie 64 MBits density). When addressing the Flash memory location, the processor reads into its 16-bit wide data bus.

Apart from storing radio firmware, the Flash also stores the Radio CodePlug (Customer related information) such as telephone numbers, addresses, etc.

SRAM Memory

This 512k x 16-bit Static RAM is used for Data storage.

Serial Peripheral Interface (SPI)

The RedCap2 uses the SPI protocol (Serial Peripheral Interface) to communicate with RF IC's (WPIC, LNODCT, ESCORT), GCAP3 IC and the display driver.

The protocol is built upon 4 lines [MOSI(Tx), MISO(Rx), CS, CLK)].

The RF IC's are connected to SPIA module, while GCAP3 and the display are connected via SPIB module.

The Display Module, based on the display driver (i.e. Samsung KS0741) uses a serial interface.

GCAP3

The Global Control Audio Power (GCAP3) IC handles DC power distribution and audio processing (ie audio amplification and analog-to-digital/digital-to-analog conversions). It contains switching and linear regulators, audio preamplifiers, 13-bit CODEC, 14-channel 10-bit A/D Converter, 8-bit D/A Converter and interfaces with an external Audio Amplifier for receive audio.

DC Power Distribution

See Figure 4.1-11

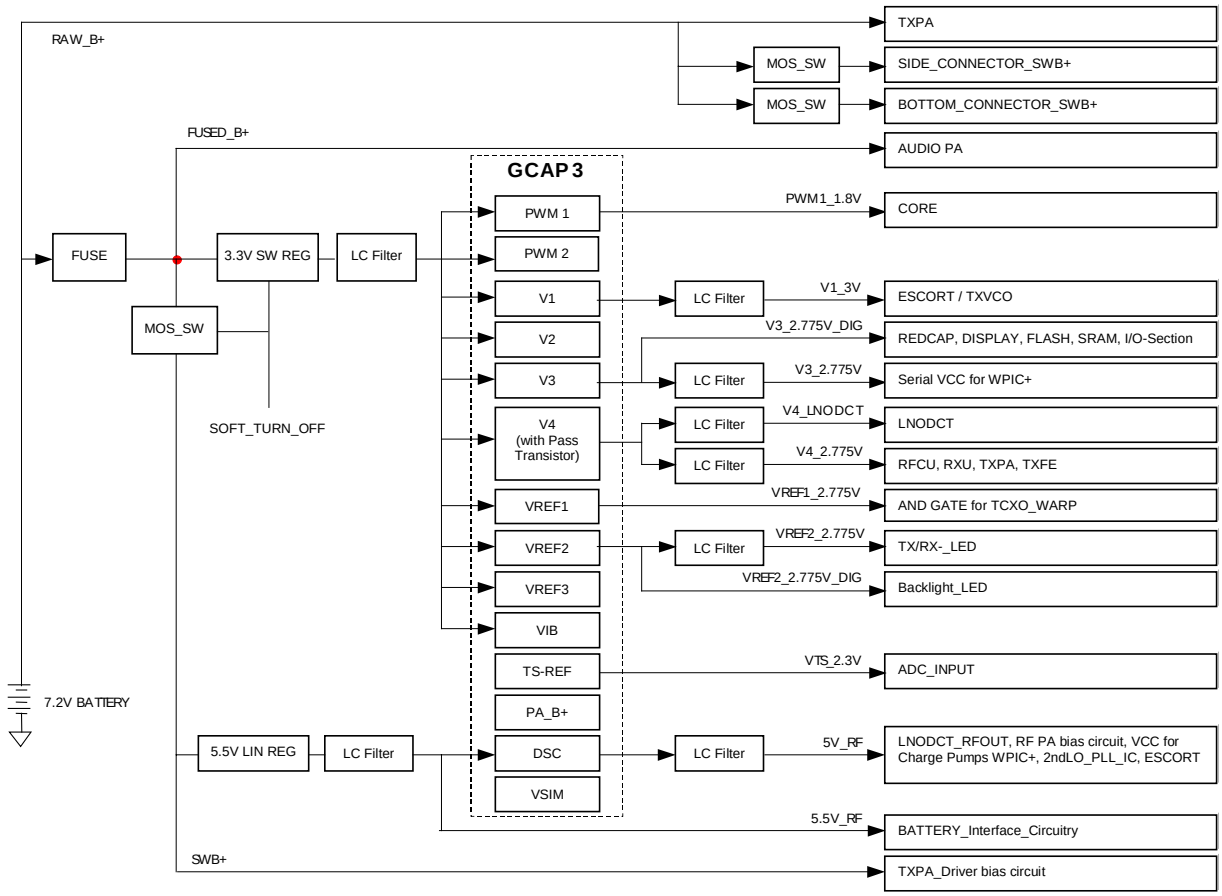


Figure 4.1-11 MTP700 DC Distribution

Several sections of the radio are connected directly to the battery, which supplies RAW_B+ and FUSED_B+. The radio operates at a low voltage of 5.8Vdc, nominal-level voltage of 7.2Vdc, and high-level voltage of 12Vdc. The battery is connected to J001 pins 3 (+) and J001 pin 1 (-). These pins supply the RAW_B+ to the RF TX power amplifier and the SWB+ current limit regulator. RAW_B+ is routed via F200 (Fuse) becoming FUSED_B+, which is used by the Audio PA, the 3.3V Switching Regulator and the SWB+ switch for the TX Driver bias circuit.

3.3V Switching Regulator

An external 3.3V switching regulator is used to convert the battery voltage (7.2V) down to 3.3V to be used by GCAP3. This regulator can be set to fixed frequency 600KHz (during Tx & Rx) or variable switching frequency (when idle) depending on the load.

PWM #1 (Pulse Width Modulation)

PWM #1 is a selectable step down switching regulator. It is selectable using the RedCap2 SPIB bus from 1.2V to 2.45V in 6 steps, Pass Through and Power down modes. The switcher is active during Power Reset (POR) in 1.875V mode. It is set to 1.875V. Switching regulator is PWM#1_1.875V, which is the supply for the internal core, emulation port and clock output drivers of the RedCap2. The switcher is supplied from FILT_3.3V and it is active whenever the radio is turned ON.

V1 Linear Regulator

V1 is a programmable linear regulator. It is programmed using the RedCap2 SPIB bus from 0.975V to 3.0V in 8 steps. This regulator is active during POR and its initial value is 1.55V. For this radio, V1 is programmed to 3.0V, supplying ESCORT section by filtered V1_3V. This regulator is active whenever the radio is turned ON.

V2 Linear Regulator

V2 is a selectable linear regulator. It is selectable using the GCAP3 UV_SEL pin (internal logic) between either 2.5V and 2.775V. This regulator is active during POR and its initial output value is set by GCAP3 UV_SEL pin. Connecting UV_SEL pin to FILT_3.3V sets V2 output value to 2.775V, connecting UV_SEL pin to Ground sets V2 output value to 2.5V. For this radio, V2 is selected to 2.775V. This regulator is supplied by FILT_3.3V and it is active whenever the radio is turned ON. V2 is the supply for internal audio circuits, CLK_IN input driver and TS interface.

V3 Linear Regulator

V3 is a selectable linear regulator. It is selectable using the RedCap2 SPIB bus from 1.875V to 2.775V in 4 steps. This regulator is active during POR and its initial output value is 2.775V. For this radio, V3 is selected to 2.775V. The regulator is supplied by FILT_3.3V and it is active whenever the radio is turned ON. V3 is directly used as V3_2.775V_DIG, which is the supply for the RedCap2, Flash, SRAM, GCAP3, Display, logic lines pull-up and 40-pin connector. V3_2.775V is the filtered V3 supply voltage for the Serial VCC of U1001/WPIC+.

V4 Linear Regulator

V4 is a selectable linear regulator with external pass transistor. It is selectable using the RedCap2 SPIB bus from 1.875V to 2.775V in 4 steps. It is set to 2.775V. V4 is always powered from FILT_3.3V and it is active whenever the radio is turned ON. This regulator is active during POR. V4 supplies via the filtered V4_2.775V the RF sections RFCU, RXU, TXPA and TXFE whilst the LNODCT section has an extra filtered supply voltage V4_LNODCT.

VREF1 Linear Regulator

VREF1 is a programmable linear regulator. It is programmed using the RedCap2 SPIB bus from 0.95V to 2.775V. This regulator is active during POR and its initial value is 2.775V. For this radio, VREF1 is programmed to 2.775V and is supplied by FILT_3.3V. VREF1 is VREF1_2.775V, which is the supply for the AND Gate on TCXO_WARP line.

VREF2 Linear Regulator

VREF2 is a programmable linear regulator. It is programmed using RedCap2 SPIB bus from 0.95V to 2.775V. For this radio, it is programmed to 2.775V which supplies directly (VREF2_2.775_DIG) the backlights and filtered (VREF2_2.775V) the SSC section (Tx/Rx-LED).

TS_REF Linear Regulator

TS_REF is a fixed output linear regulator. It is supplied internally from the V2 linear regulator. It is set to 2.3V. The radio uses TS_REF for the AD voltage dividers. It is not active at POR.

5.5V Linear Regulator

This is an external linear regulator fed by SWB+. It is used to supply GCAP3 DSC regulator and the Battery Interface Circuitry.

DSC Linear Regulator

DSC is a fixed output linear regulator. This regulator is active during POR in the 5V mode. DSC is supplied from an external 5.5V linear regulator. The output voltage is filtered (5V_RF) to supply the WPIC+, 2nd LO PLL-IC and ESCORT-IC charge pump circuits, the PA bias OP and LNODCT_RFOUT circuit.

Current Limit

The SWB+ current limit regulator provides power from the phone battery to clip-on accessories. It is enabled only when the phone is powered up and an accessory which requires power from the phone is connected.

Radio Audio System

See Figure 4.1-12

The audio system consists of the GCAP3 IC (U200) and the DSP (U301), both are located on the main board.

The GCAP3 performs the analog task and part of the digital task of the audio system.

Tx Path

Audio speech is fed either to the internal microphone or the external microphone. The signals reach the GCAP3 IC. In the GCAP3 IC, a fix gain amplifier (A3 or A5) provides the signal amplification, the multiplexer (MUX) selects the active input and the Programmable Gain Amplifier (TxPGA) adjust the path gain according to the radio mode of operation. Finally, the A/D converts the analog signal into digital format and transfers it to the DSP. The DSP performs the functions of audio filtering, ACELP speech compression, forward error correction (FEC), digital modulation, and transfers the data to the RF section. When the radio is operating in the telephone interconnect mode, the DSP performs the required tasks such as echo and noise reduction.

Rx Path

The digital output signal from the receiver is fed to the DSP which performs the functions of digital de-modulation, FEC, ACELP speech de-compression, and audio filtering. It transfers the data to the GCAP3 IC. In this IC, the D/A converts the digital audio format to an analog signal, the Programmable Gain Amplifier (RxPGA) adjusts the path gain according to the setting of the volume control, and the multiplexer routes the audio to the active receive path. The audio is fed to A4, single-ended audio power amplifier. It is then fed to the Audio PA, where most of the amplification is performed and can be selected either to go through the internal speaker or external speaker. Altenatively, the audio from GCAP3 can also be sent through A1 to the internal Earpiece.

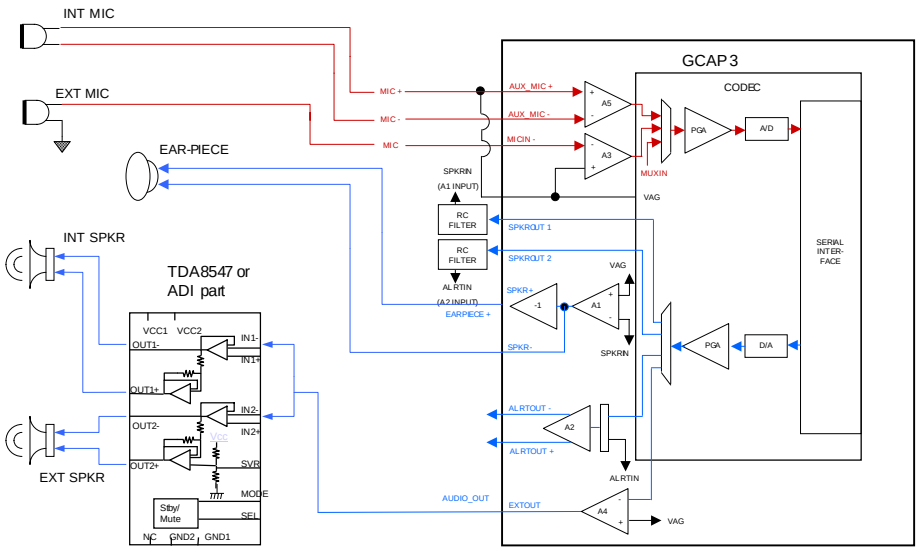


Figure 4.1-12 Audio Path - Block Diagram

RS232, SB9600, JTAG

The RedCap2 processor (RCE) uses the three serial protocols: RS232/UART, SB9600, and JTAG to communicate with external devices via the bottom connector of the unit. There is no external hardware for switching from one protocol to another because the RedCap2 handles the switching and line multiplexing functions internally.

Battery ID

The battery is equipped with a Dallas 2502 EPROM. A one-wire serial bus allows the radio or the battery charger to communicate with the battery and identify whether or not the battery is compatible. If the battery is determined to be incompatible, the unit automatically shuts off, and the charger does not enter charging mode.

Besides compatibility data, the EPROM also stores the following information: battery type, capacity, fuel-gauging parameters, and voltage threshold.

Display and Keypad, Detailed Description

Display

The LCD (Liquid Crystal Display) Module is a Graphic Display based upon the KS0741TB-01 display driver.

It consist of LCD Holographic Glass, LED backlight and a 22 pin flex cable connected to the Keypad board.

The Communication to the RedCap2 IC is performed using a SPI protocol (Serial Peripheral Interface). The Operation of the LCD is determined upon the RS line configuration (Data/Command).

The Display is 128X100 (Columns X Rows respectively).

Keypad

The RedCap2 processor (RCE) is responsible for decoding key presses and displaying them properly on the LCD. The keys are arranged into a matrix of five rows and five columns, which includes the Volume and PTT keys.

The PWR key is not decoded by the RCE; it directly drives the GCAP3, which sends a signal to RCE through INT1. The five row lines are pulled high via five internal 22 Kohm resistors. The five row lines and five column lines are fed to RedCap2 I/O pins. Pressing any key also generates the keypad internal interrupt. The RedCap2 debounces the keys by reading them 25 milliseconds later.

The keypad-decoding scheme works as follows:

1. RedCap2 sets rows to inputs; all columns are set as outputs and driven logic low.
2. Rows are pulled logic high. When a key is pressed, one row goes low, which indicates a key press and sends an internal interrupt.
3. RedCap2 reads rows. A low on that row indicates a key press. All others are high.
4. RedCap2 sets all columns to output logic high.
5. One column at a time is set to output logic low. RedCap2 reads the columns to see which one is now at a logic low level.
6. The low row level (in step 3) and low column level (in step 5) indicate the correct column and row.

All keypad circuitry is located on the keypad board. Refer to the keypad board schematics.

Backlight and LEDs

Backlight

The keypad backlight consists of 8 green LEDs. There are 2 more LEDs in the LCD module that are connected in parallel to the keypad LEDs.

Top LEDs

There is a tri-color (Green, Red and Amber when both turns on) LED located on the main board. These LED colors are used as indicators to the radio operation.

Radio Programming

The radio is entered into programming mode by setting the MOD pin high level, and applying a preamble sequence to the radio via the RS232 lines. A 12Vdc can be applied to pin 15 on the 16-pin connector to set the radio into flashing mode.

The MOD pin assertion is encountered at least 4 CKIH cycles before the negation of the Reset pin.

Accessory Connector

The radio provides two connectors for access to personal computers, data devices and audio accessories.

Bottom Connector

The 14-pin bottom connector is intended to support connection to personal computers, and test systems. The bus has seven standard modes of operation: Normal (Nothing Connected), USB Mode, Emergency, PTT, RS232 Mode 4-wire, RS232 8-wire/SSI Mode and SB9600 mode. There are also three additional non-standard modes, KEYLOAD, FLASH, and JTAG, which are used only for secure keyloading, development, factory programming and debugging.

These modes are selected by applying appropriate logic levels to the Option Select pins, named OPTION1 and OPTION2. Some of the modes listed above are selected by the additional application of a level on the USB POWER and CE_ON_OFF pins as well.

Mode Select (OPTION1 and OPTION2)

Logic levels applied to the OPTION1, OPTION2, USB POWER, and ON_OFF/JTAG/FLASH lines are used to select the different modes. The modes will be set as follows:

Table 4.1-1 Bottom Connector Mode Table

	MODE	ON_OFF/ JTAG/ FLASH	BOTTOM OPTION1	BOTTOM OPTION2	USB PWR
Standard Modes	Normal (No Accessory)	0	1	1	0
	USB Accessory / Computer	0	1	1	>4.0V
	Emergency	0	1	0	X
	RS-232 (4 wire) / SSI	0	*		X
	PTT (Push To Talk)	0	0	0	X
	RS-232 (8 wire)	0	0	1	X
	SB9600	0	*		X
Non Standard Modes	KEYLOAD	0	----		X
	FLASH	11.4-12.6 V	X	X	X
	JTAG	7.6-8.4 V	X	X	X

Note: * Schottky Diode with forward voltage less than 0.4V.

Logic Levels

1 : 2.0V to 2.85V, typical 2.775V
0 : 0V to 0.8V
X : Do Not Care Condition

Pin No.	Signal Name (Short_Form)	Power/ Default States	USB	RS232/ SSI	RS232 (8 wire)	SB9600	JTAG
1	Power Ground (GND)	GND	GND	GND	GND	GND	GND
2	USB+/TXD (D+)/TDO		D+	TXD	TXD	TXD	TDO
3	USB-/RXD (D-)/TDI		D-	RXD	RXD	RXD	TDI
4	USB Power/RTS/Reset_In		USB_ PWR	RTS	RTS	BUSY IN	RESET_IN
5	SWB+	SWB+	SWB+	SWB+	SWB+	SWB+	SWB+
6	CTS/MCU_DE			CTS	CTS	BUSY OUT	MCU_DE
7	FS/DCD/DSP_DE			FS	DCD		DSP_DE
8	SCK/RI/TCK			SCK	RI		TCK
9	SRDA/DTR/TMS			SRDA	DTR		TMS
10	STDA/DSR/TRST			STDA	DSR		TRST
11	Bottom_Option_1 (BOT_OPT1)	BOT_ OPT1	BOT_ OPT1	BOT_ OPT1	BOT_ OPT1	BOT_ OPT1	BOT_ OPT1
12	Bottom_Option_2 (BOT_OPT2)	BOT_ OPT2	BOT_ OPT2	BOT_ OPT2	BOT_ OPT2	BOT_ OPT2	BOT_ OPT2
13	On_Off/JTAG/FLASH Mode (On_Off/JTAG)	On_Off /JTAG	On_Off /JTAG	On_Off /JTAG	On_Off /JTAG	On_Off /JTAG	On_Off /JTAG
14	Headset Indication/Key_Fail	Key	Key	HS/Key	Key	Key	

Table 4.1-2 Bottom Connector Pin Out Table

Side Connector

The side connector is intended to support connection to accessories such as PSM, RSM, Headset, 2 or 4-wire data terminals and SB9600 based devices.

The side connector has 16 modes of operation as shown in Table 4.1-3.

In order to be compatible with previous generation radios, the modes of operation are selected by applying the appropriate logic levels to the Side Option Select Pins named SIDE_OPTION1, SIDE_OPTION2. In addition, SIDE_OPTION3 will be used to select the other modes as per Table 4.1-3. Voltage level for SIDE_OPTION3 is per Table 4.1-4.

Table 4.1-3 Side Connector Mode Table

	Mode	SIDE OPTION1	SIDE OPTION2	SIDE OPTION3
1	Ext PTT	0	0	V4
2	Emergency	0	0	V3
3	Volume Up	0	0	V2
4	Volume Down	0	0	V1
5	Man Down	0	0	V0
6	MAP27	1	0	V4
7	Spare	1	0	V3
8	SB9600/SBEP	1	0	V2
9	4-Wire Data (RS232)	1	0	V1
10	2-Wire Data (RS232)	1	0	V0
11	Ext Spkr	0	1	V4
12	RSM with earbud	0	1	V3
13	RSM/PSM	0	1	V2
14	User Programmable 2	0	1	V1
15	User Programmable1	0	1	V0
16	Idle	1	1	V4

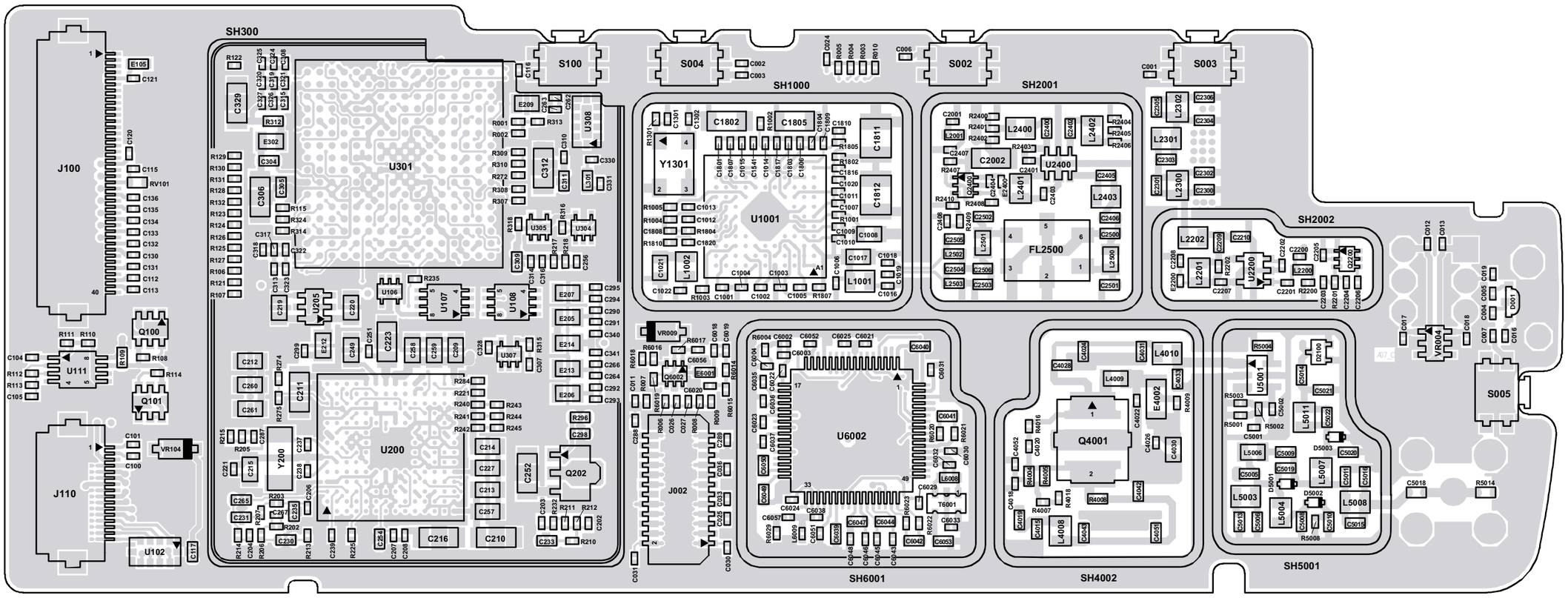
Symbol	Min Level/V	Typical/V	Max Level/V
V0	0	0.3	0.58
V1	0.62	0.8	0.98
V2	1.02	1.2	1.38
V3	1.42	1.6	1.78
V4	1.82	2.1	2.30

Table 4.1-4 Voltage Levels for Side Option3

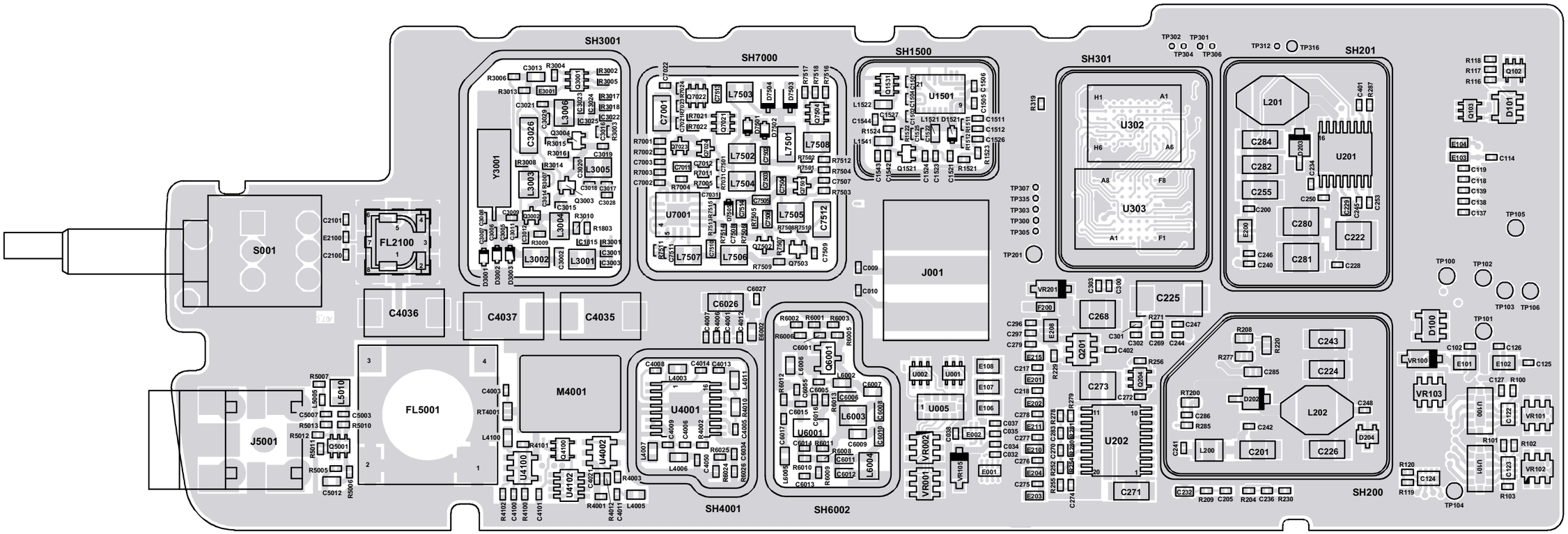
Pin No.	Signal Name
1	Ext_Speaker+
2	Ext_Speaker-
3	OPT B+
4	Ext_Mic
5	SIDE_OPT2
6	SIDE_OPT1
7	GND
8	Rx_Data
9	Tx_Data
10	CTS / BUSY_OUT
11	RTS / BUSY_IN
12	SIDE_OPT3
13	VIBRATOR

Table 4.1-5 Side Connector Pin Out Table

380-430 MHz Board Layout, Schematics & Parts Lists



380-430 MHz Main Board Top Side PCB No. 8466547A08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J5001
M4001
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U001
U002
U005
U302
U303
U201
U202
U4001
U6001
U4100
U4102
U4002
Y3001
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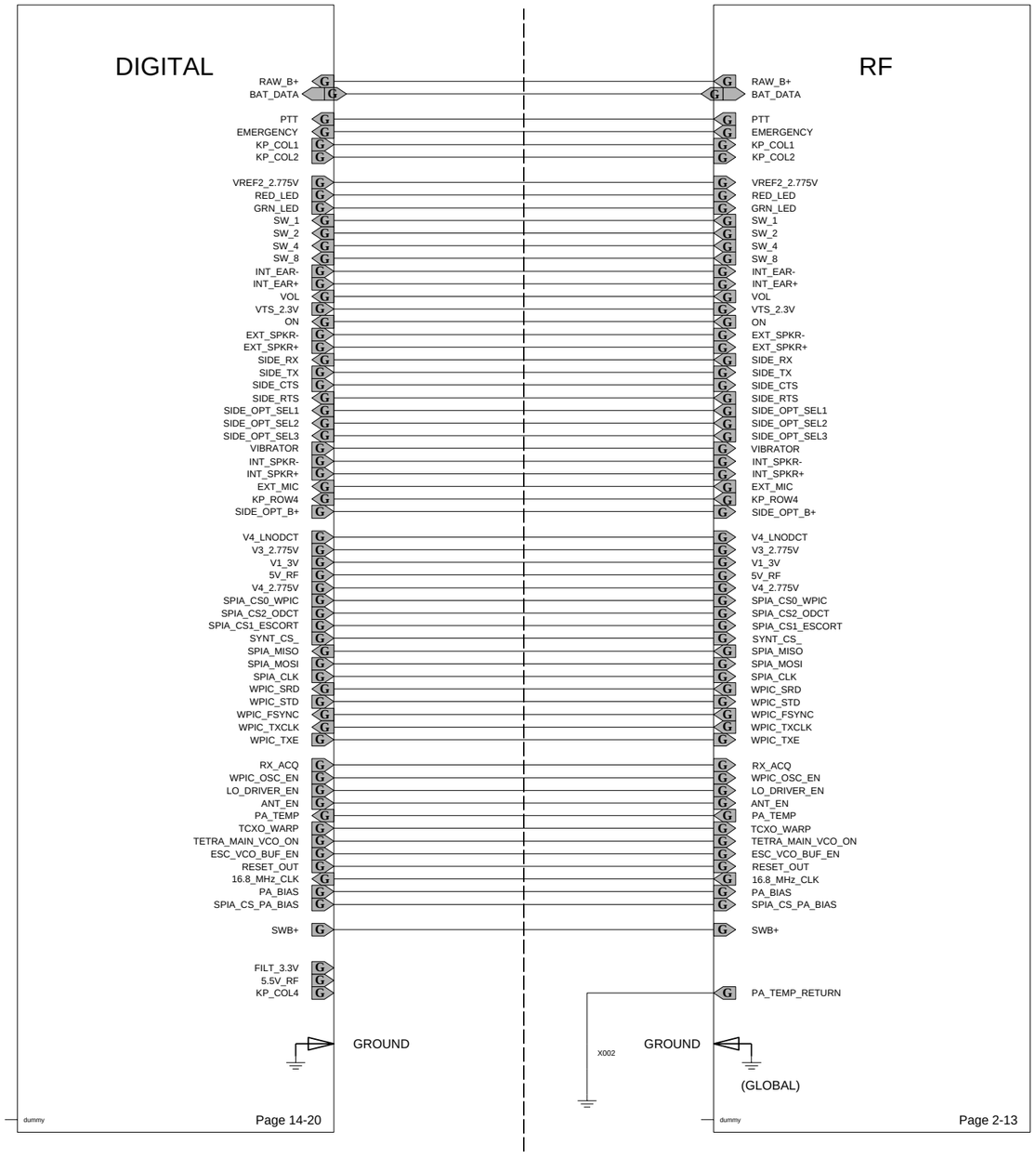
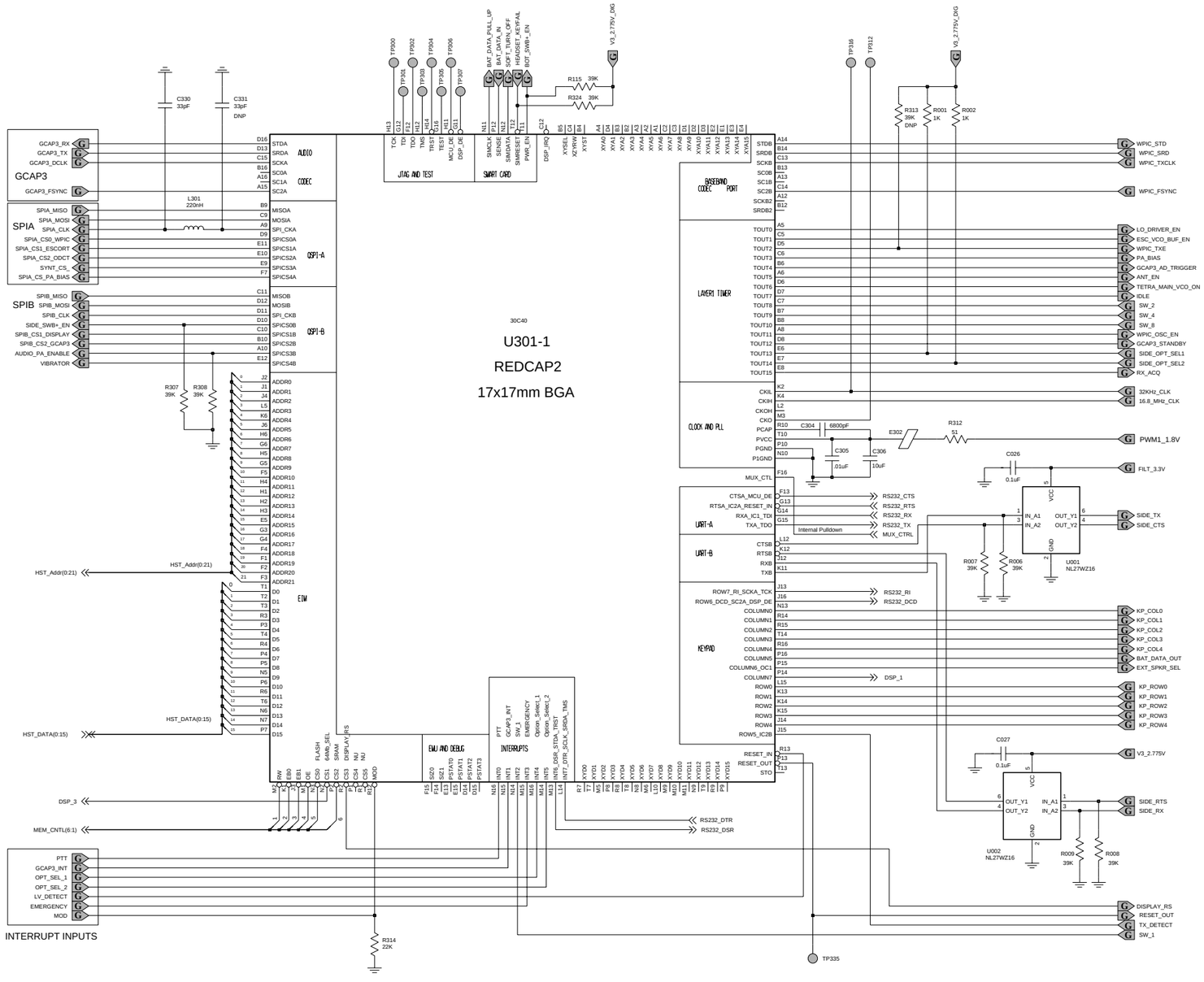
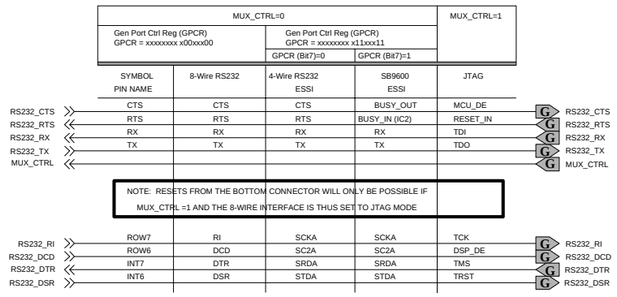
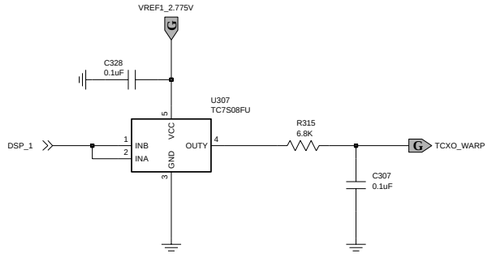


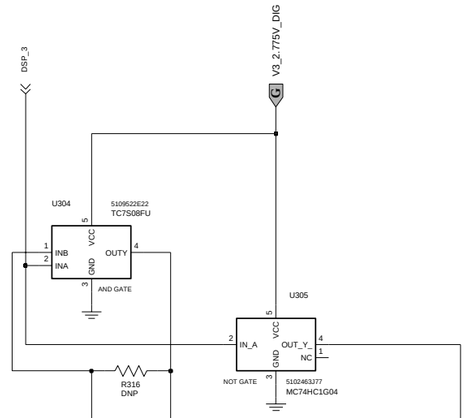
Digital and RF Block Diagram



DSP, Controller & Memory Schematic Diagram (RedCap2)

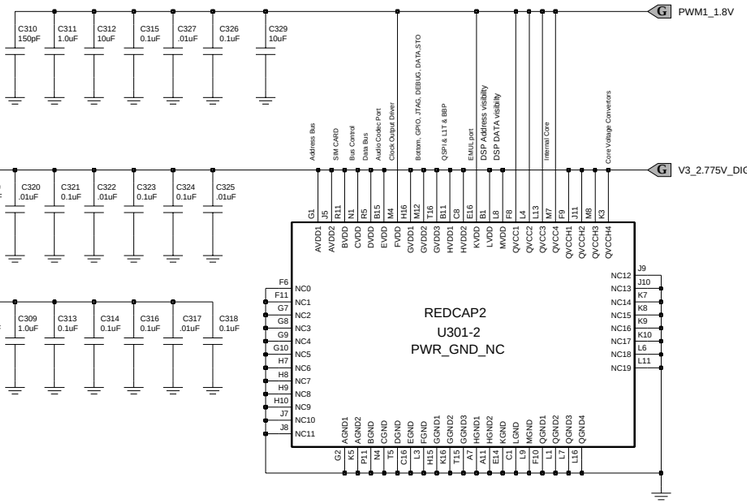


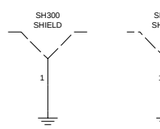


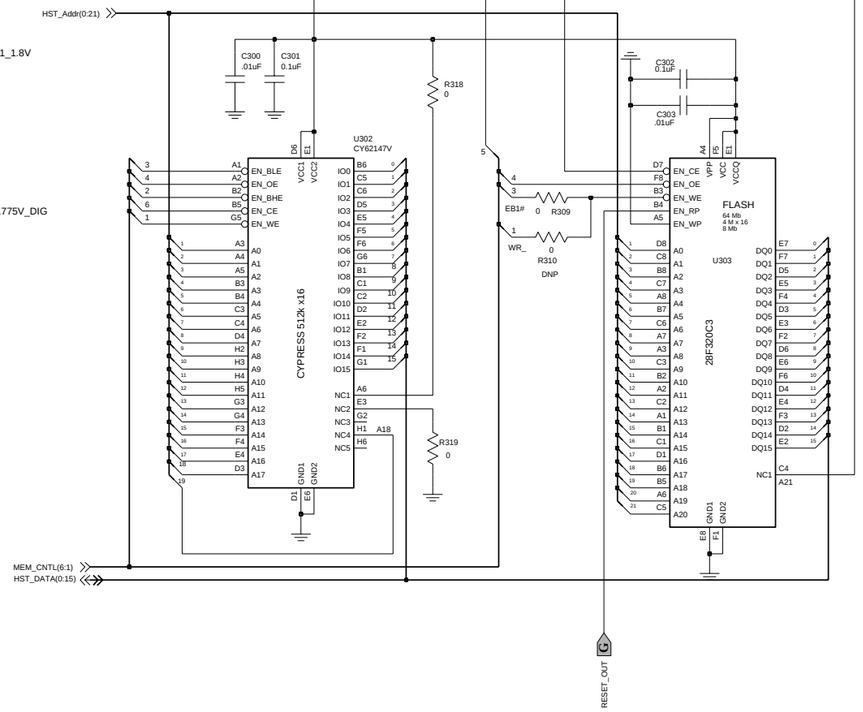


Bypass Caps for REDCAP

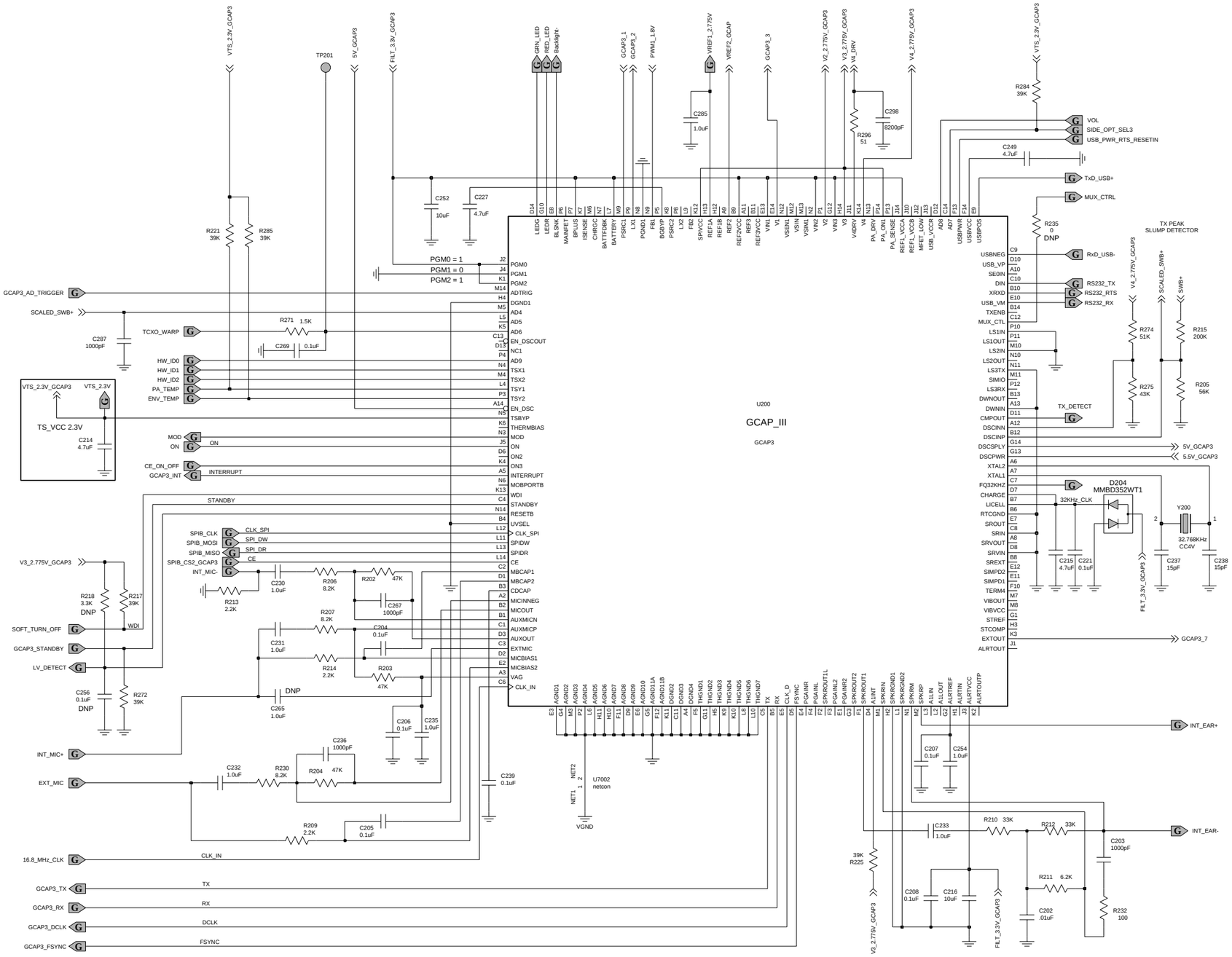
Type of SRAM (U302)	A6 CS2 R318	E3 Vss R319
256K x 16 CYPRESS	DNP	DNP
256K x 16 SAMSUNG	X	DNP
512K x 16 CYPRESS	X	DNP
512K x 16 SAMSUNG	X	X



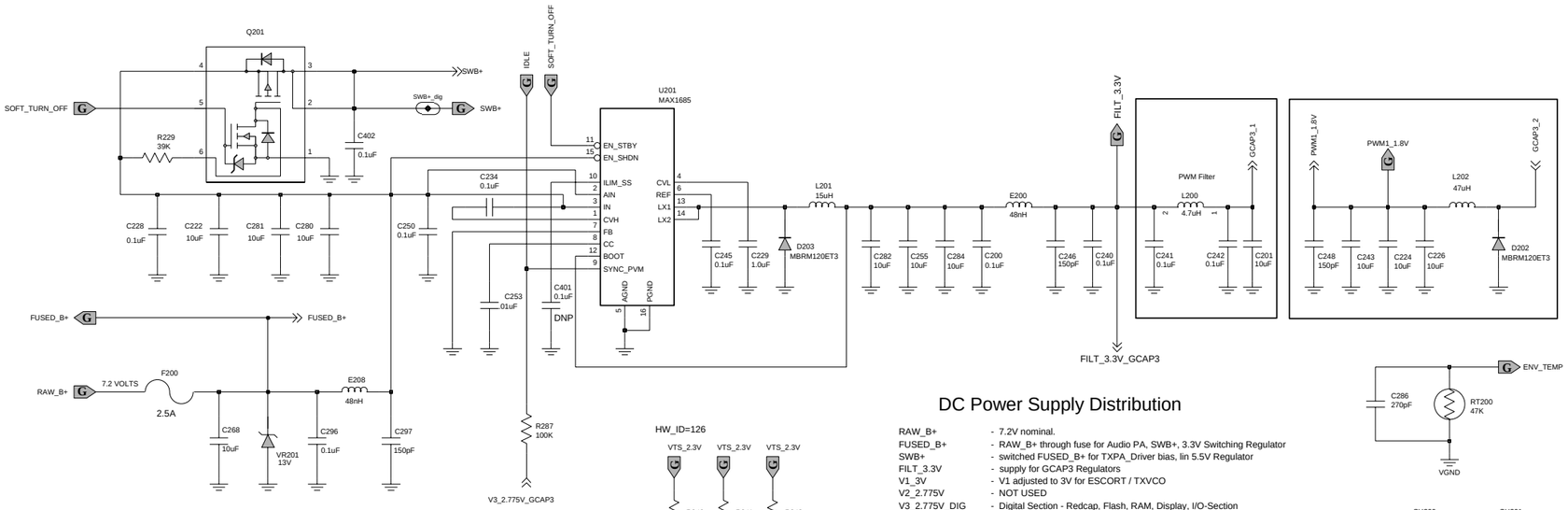




DSP, Controller & Memory Schematic Diagram (Memory)

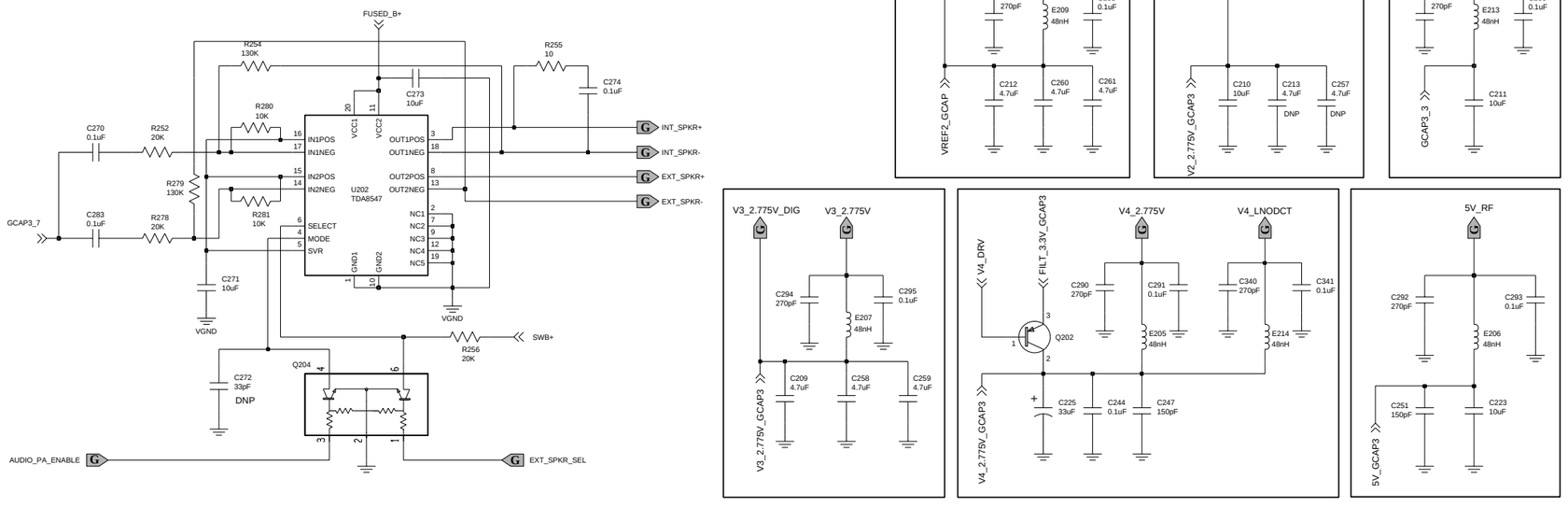


GCAP (Audio & DC) Schematic Diagram - GCAP3

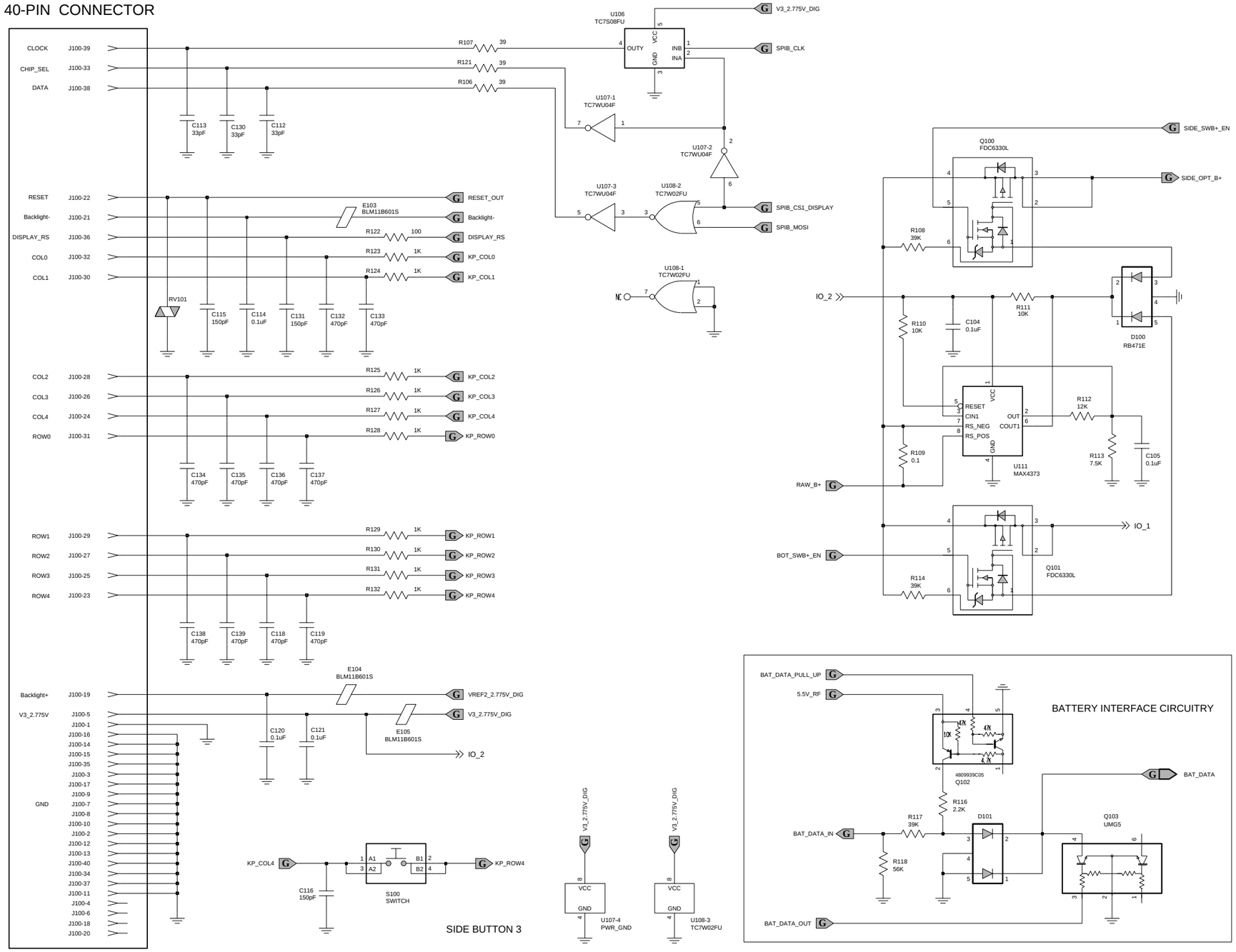


DC Power Supply Distribution

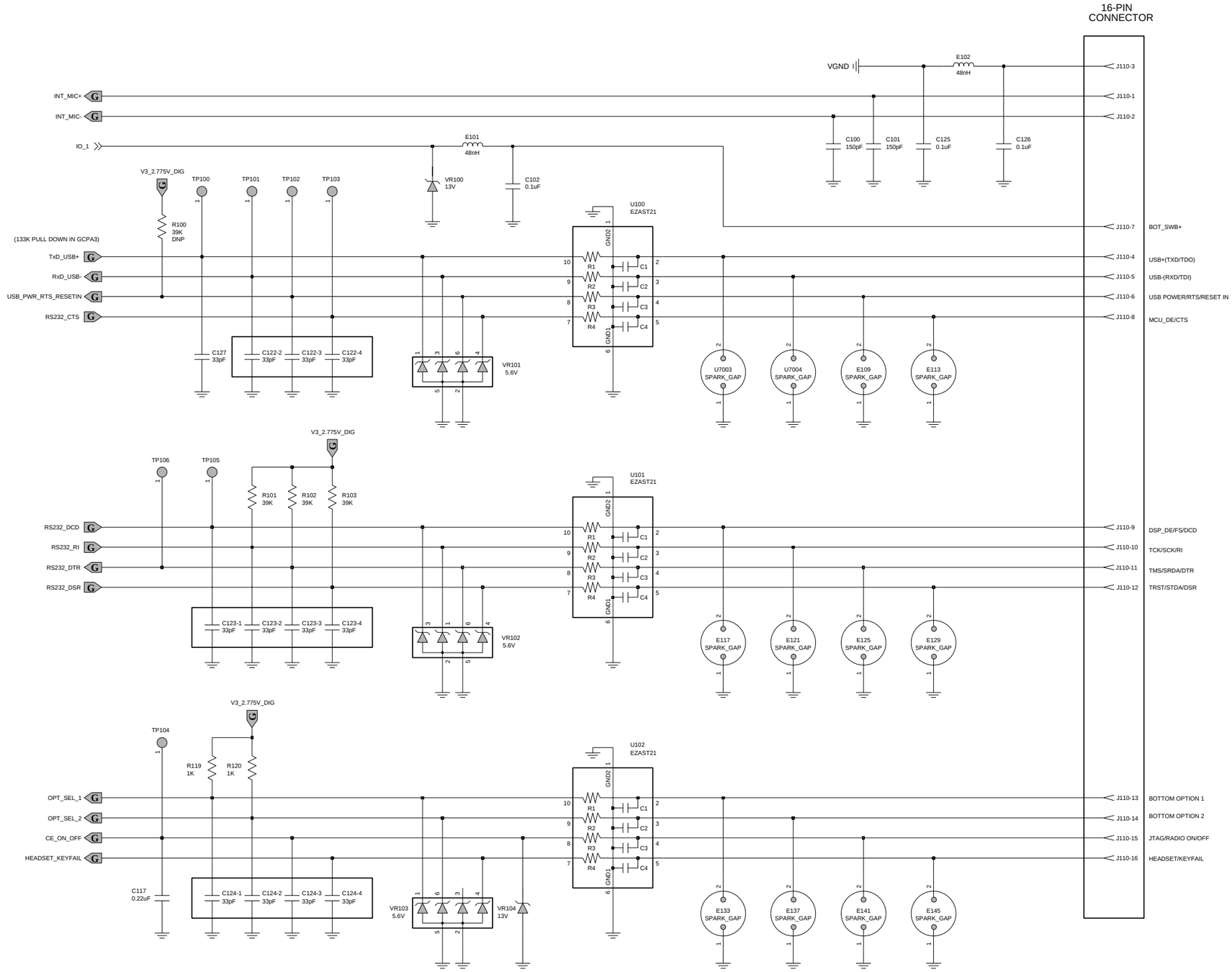
RAW_B+	-	7.2V nominal.
FUSED_B+	-	RAW_B+ through fuse for Audio PA, SWB+, 3.3V Switching Regulator
SWB+	-	switched FUSED_B+ for TXPA_Driver bias, lin 5.5V Regulator
FILT_3.3V	-	supply for GCAP3 Regulators
V1_3V	-	V1 adjusted to 3V for ESCORT / TXVCO
V2_2.775V	-	NOT USED
V3_2.775V_DIG	-	Digital Section - Redcap, Flash, RAM, Display, I/O-Section
V3_2.775V	-	serial VCC of WPIC+
V4_2.775V	-	RFCU, RXU, TXPA, TXFE
V4_LNODCT	-	LNODCT
VREF1_2.775V	-	AND-GATE for TXCO_WARP
VREF2_2.775V_DIG	-	Backlight_LED
VREF2_2.775V	-	SSC - TX/RX-LED, Frequency switch
VTS_2.3V	-	Bias for the A/D inputs.
5,5V_RF	-	Battery Interface circuitry
5V_RF	-	LNODCT_RFOUT, RF PA bias, Vcc for Charge Pumps



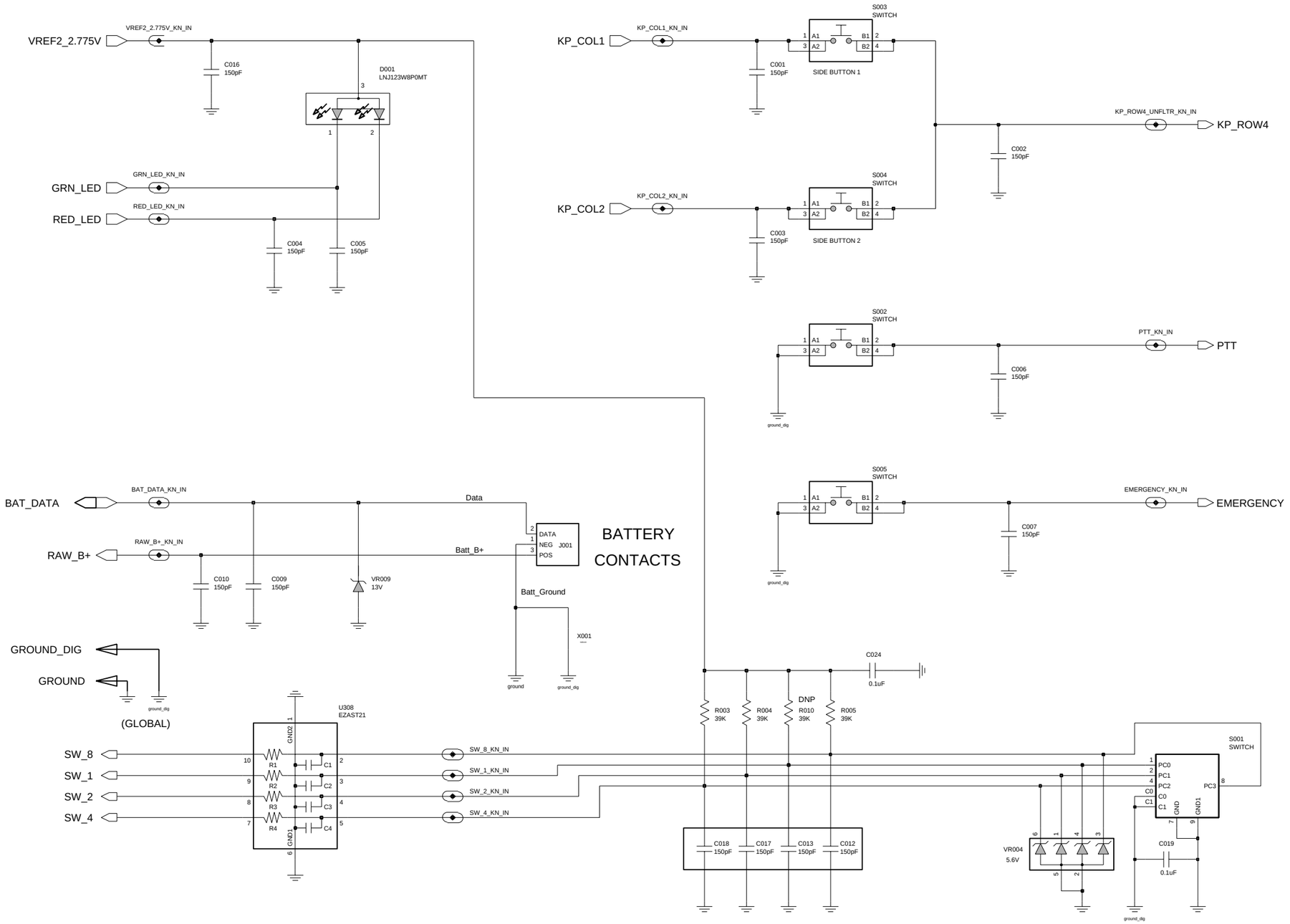
GCAP (Audio & DC) Schematic Diagram - Periphery



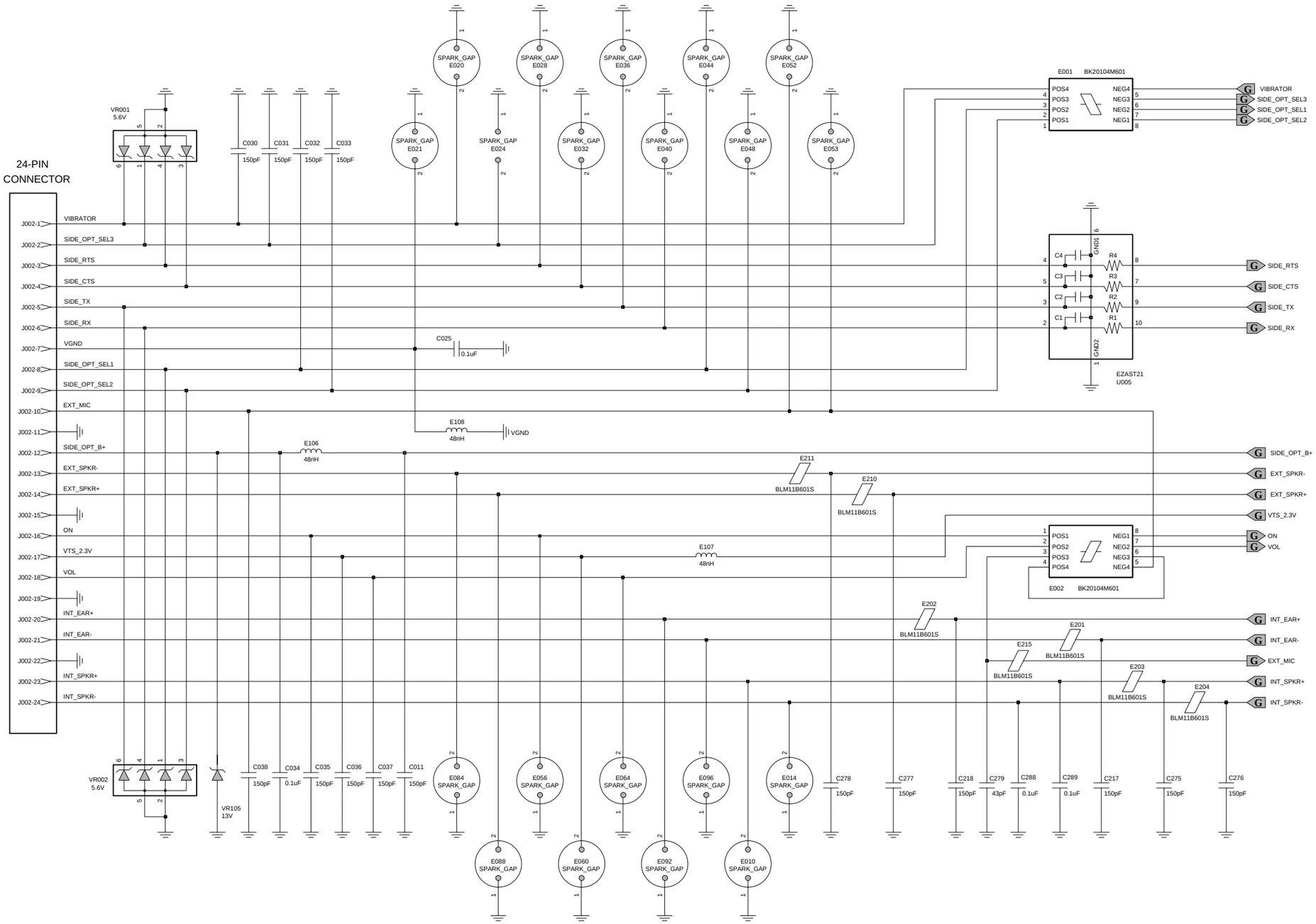
IO Interface & Connectors
Schematic Diagram - 40 Pin Connector



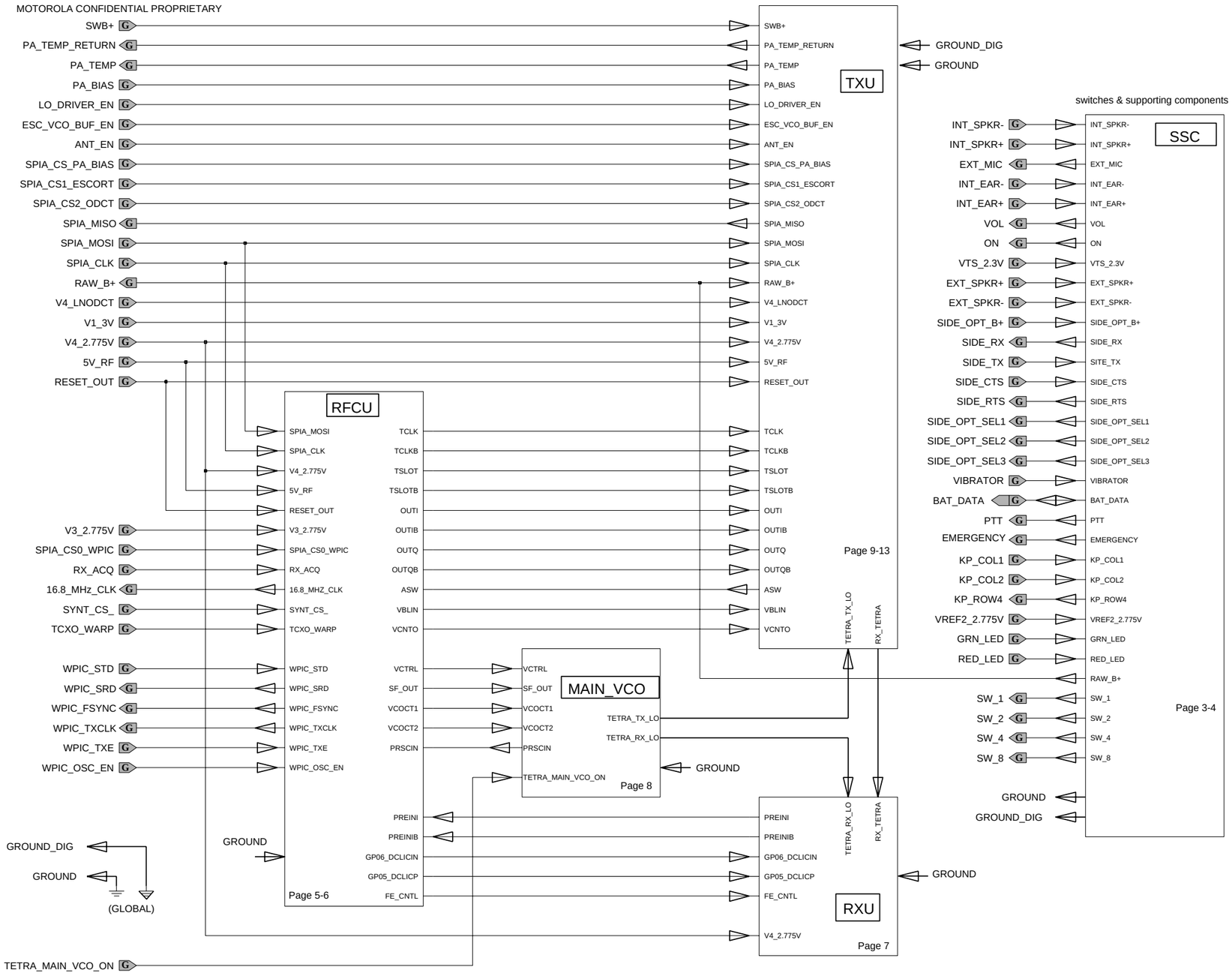
IO Interface & Connectors
Schematic Diagram - 16 Pin Connector



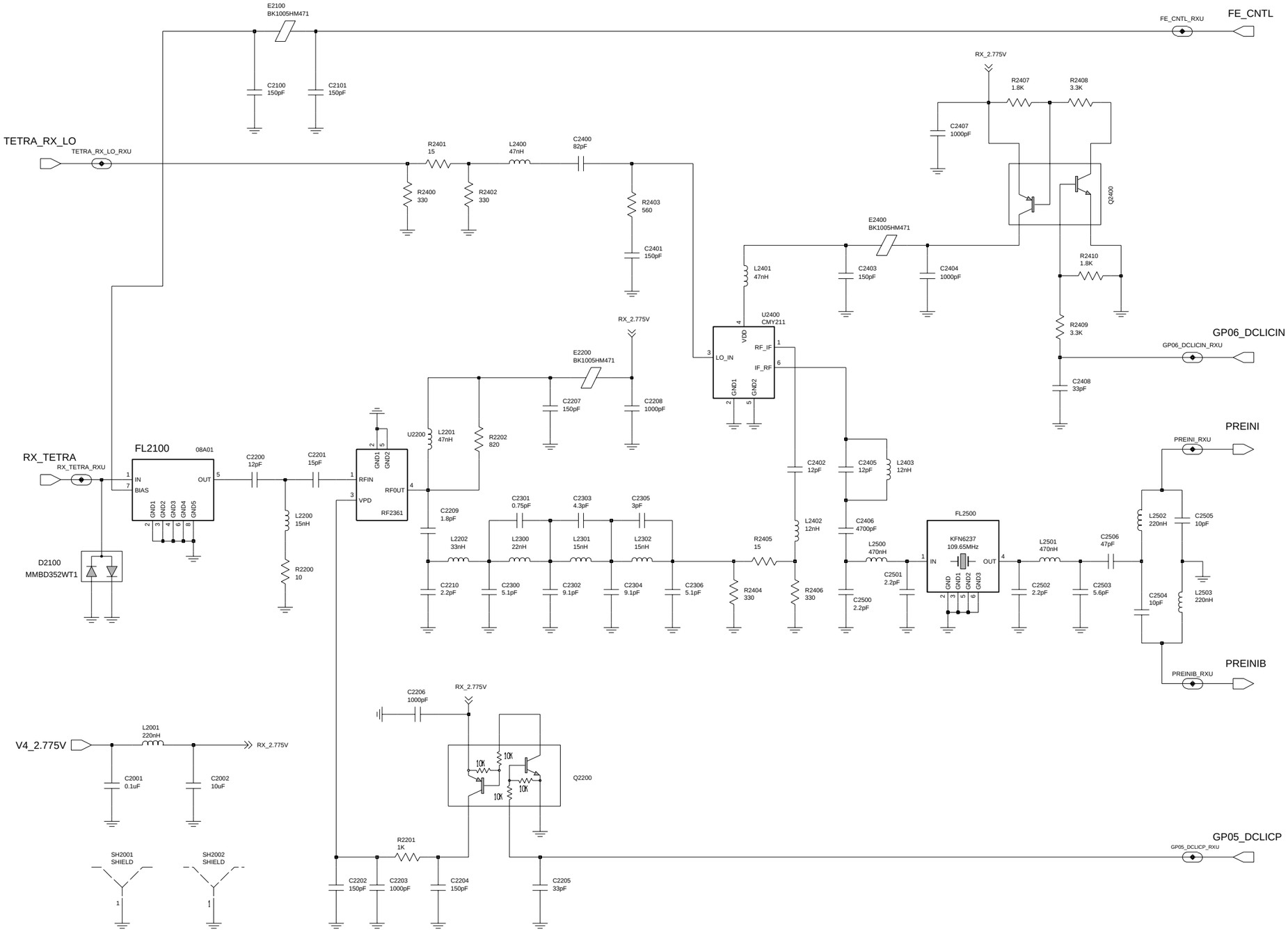
Switches & Associated Components
Schematic Diagram - Switch



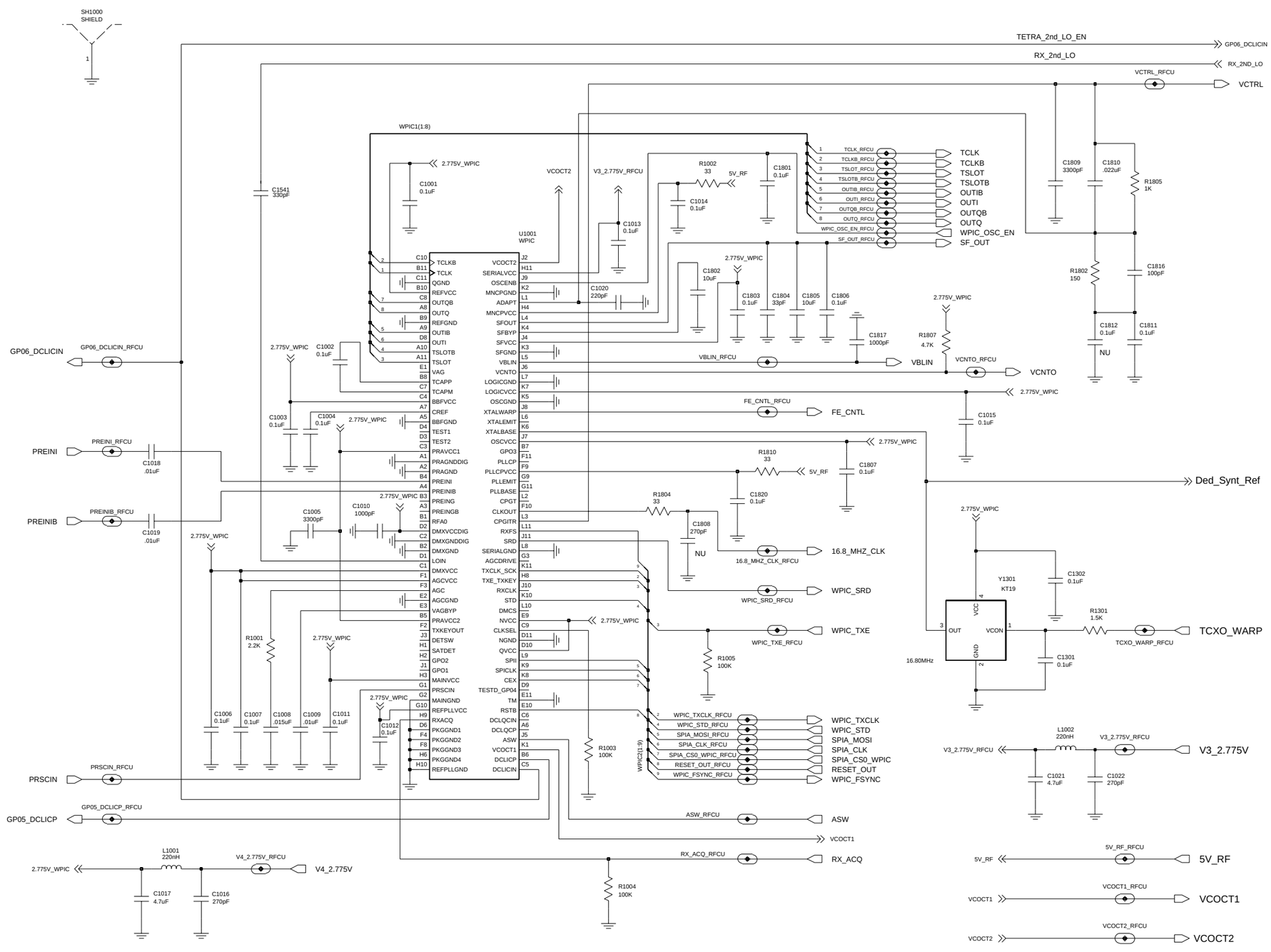
Switches & Associated Components
Schematic Diagram - 24 Pin Connector



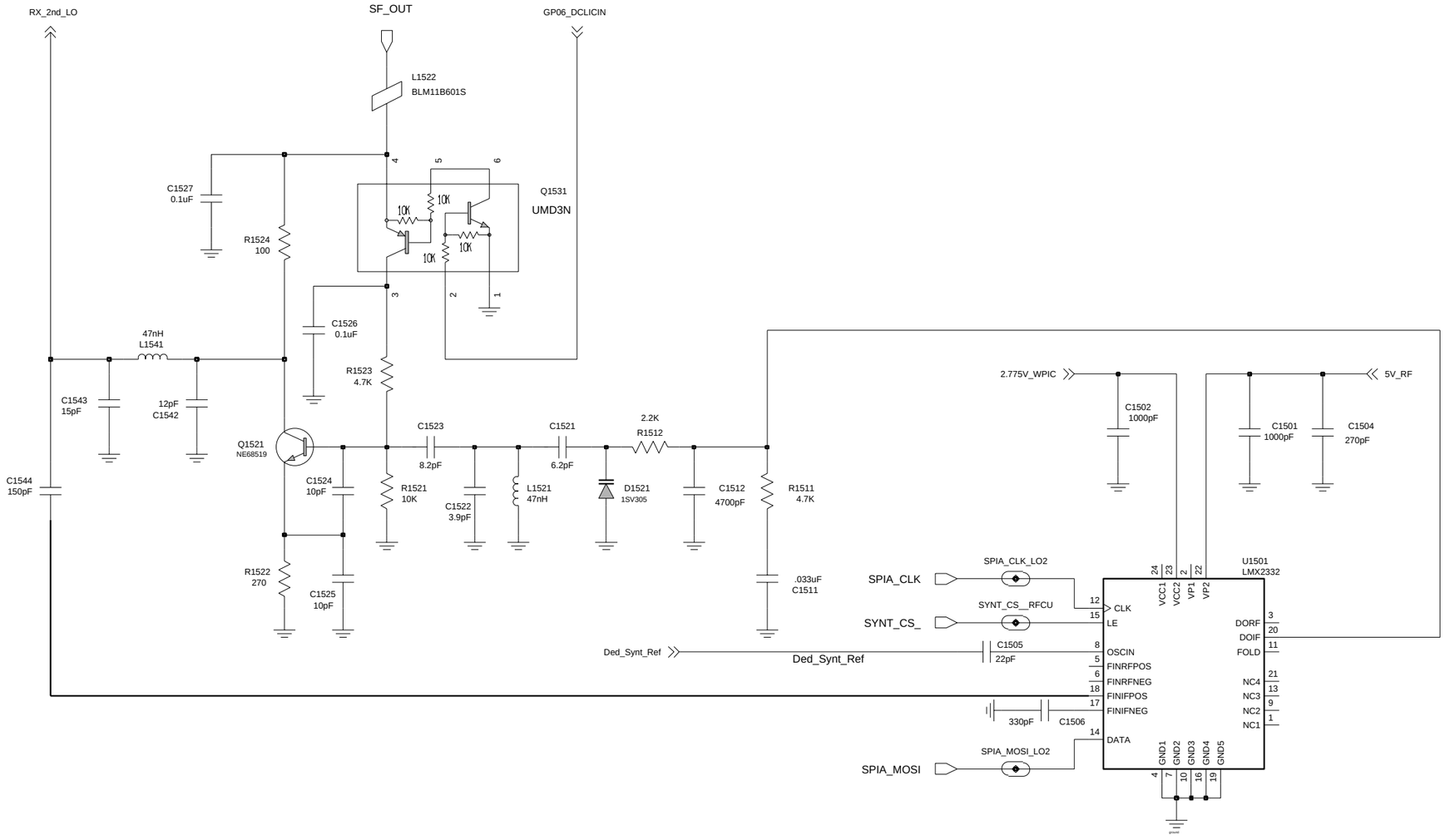
RF Section Block Diagram

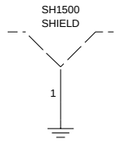


RXU Schematic Diagram

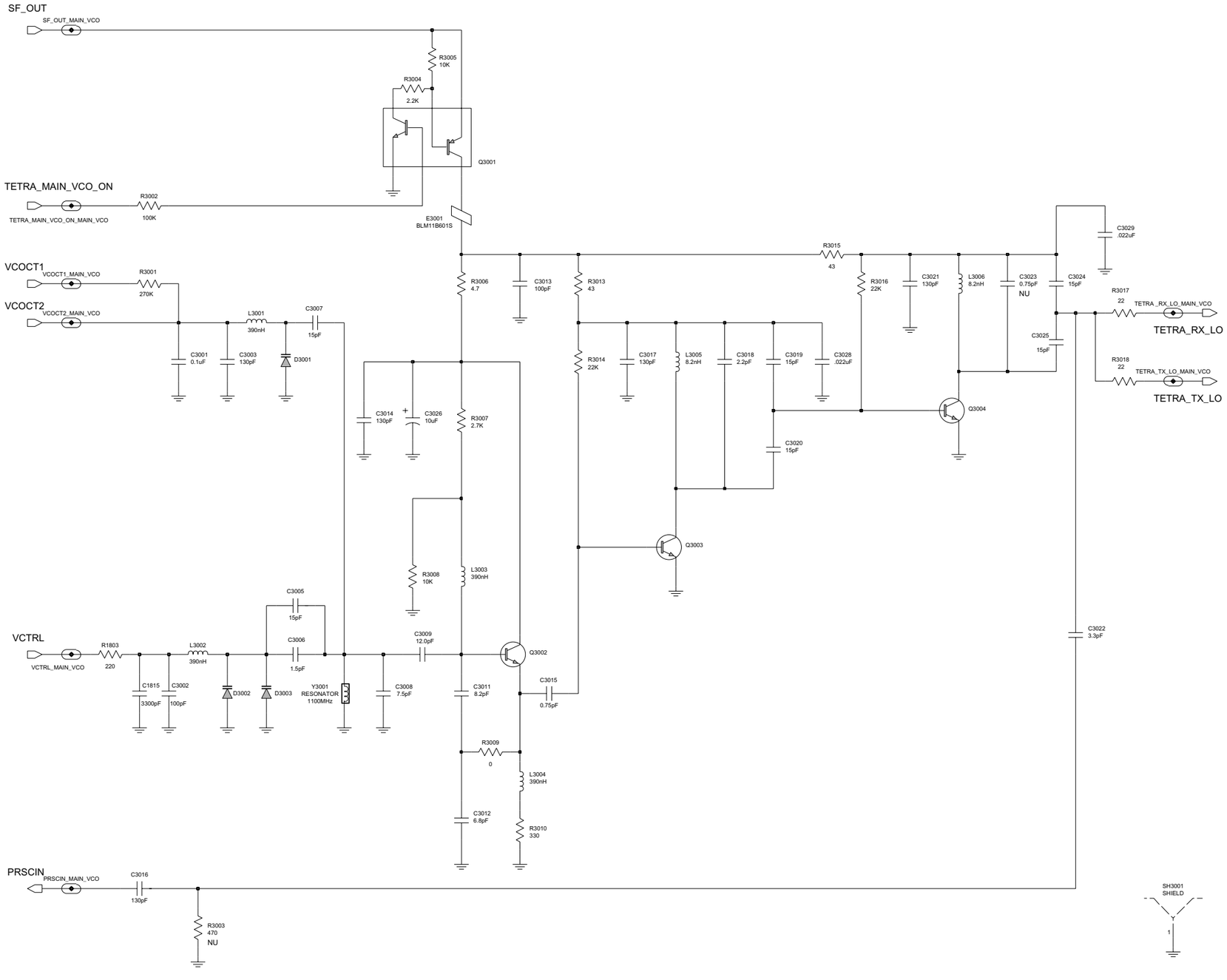


RF Core Unit Schematic Diagram - WPIC

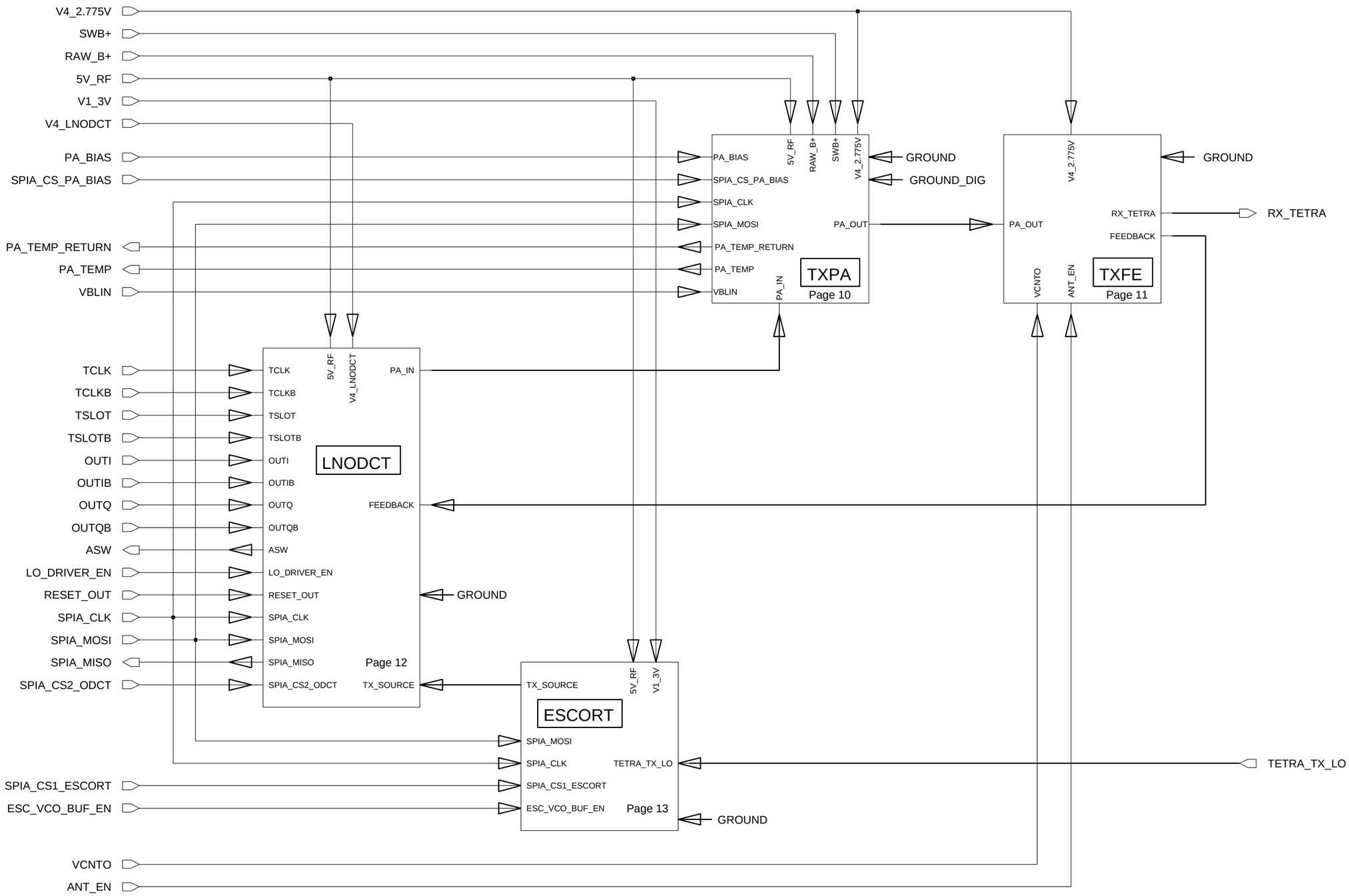




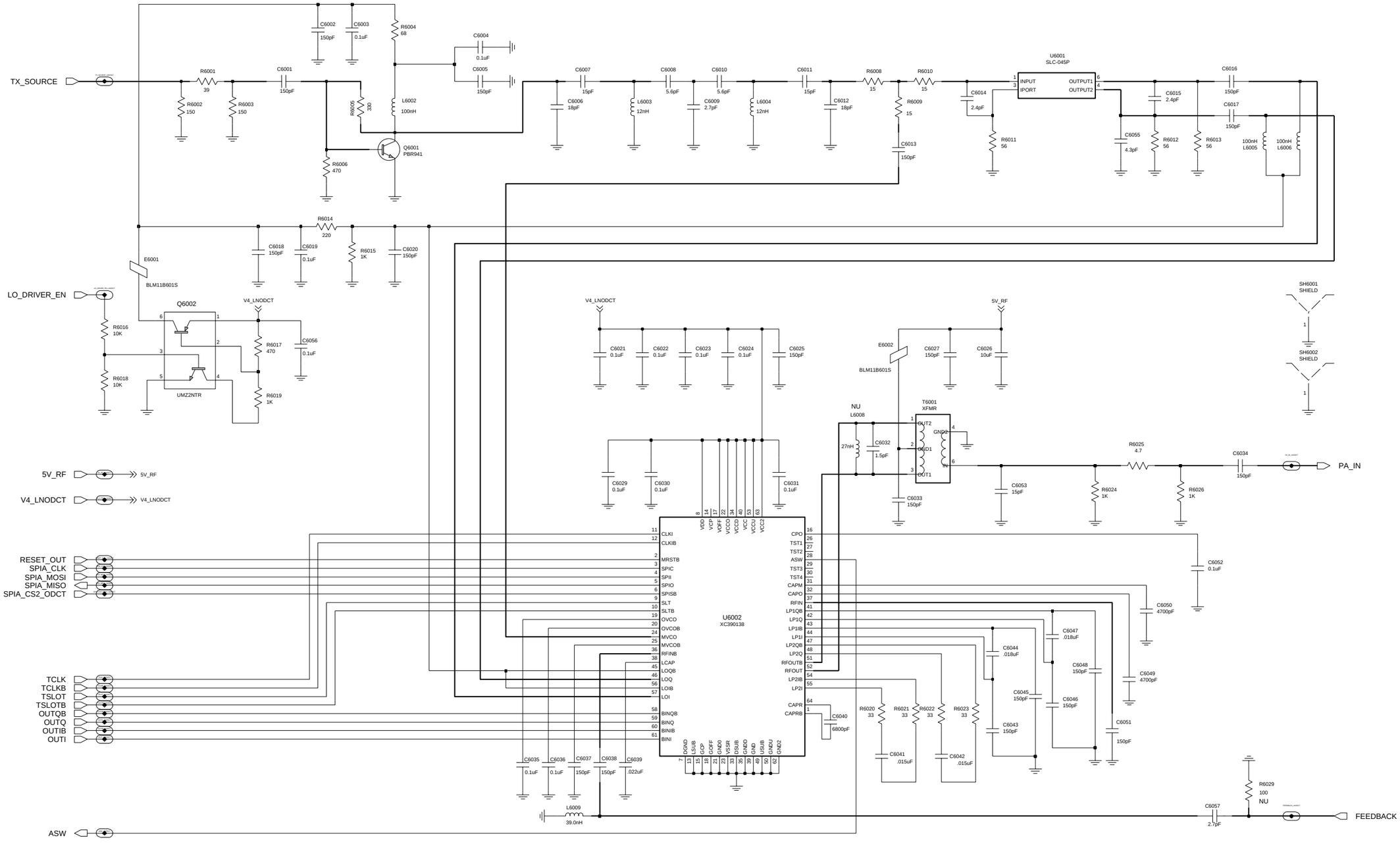
RF Core Unit Schematic Diagram - 2nd LO



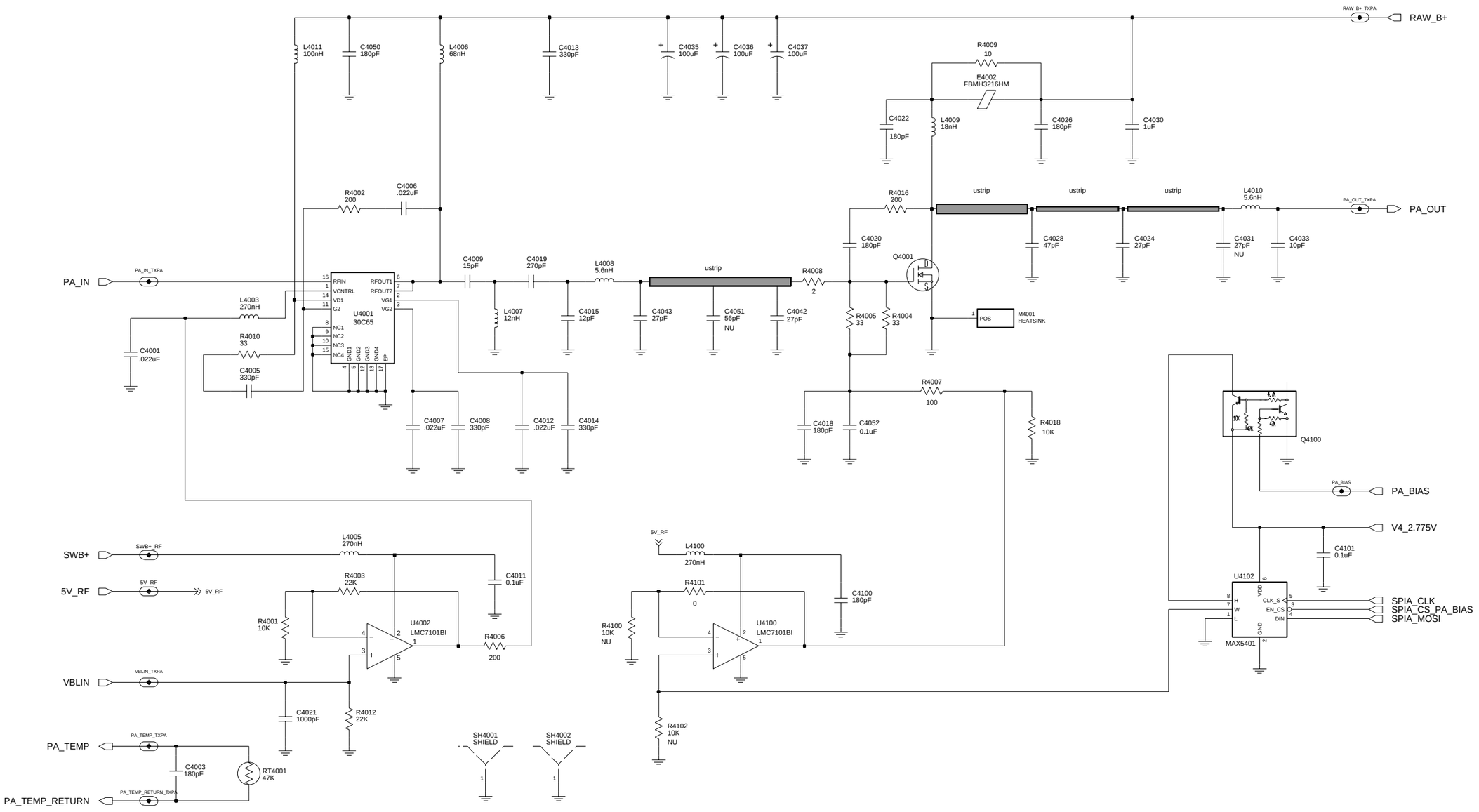
Main VCO Schematic Diagram



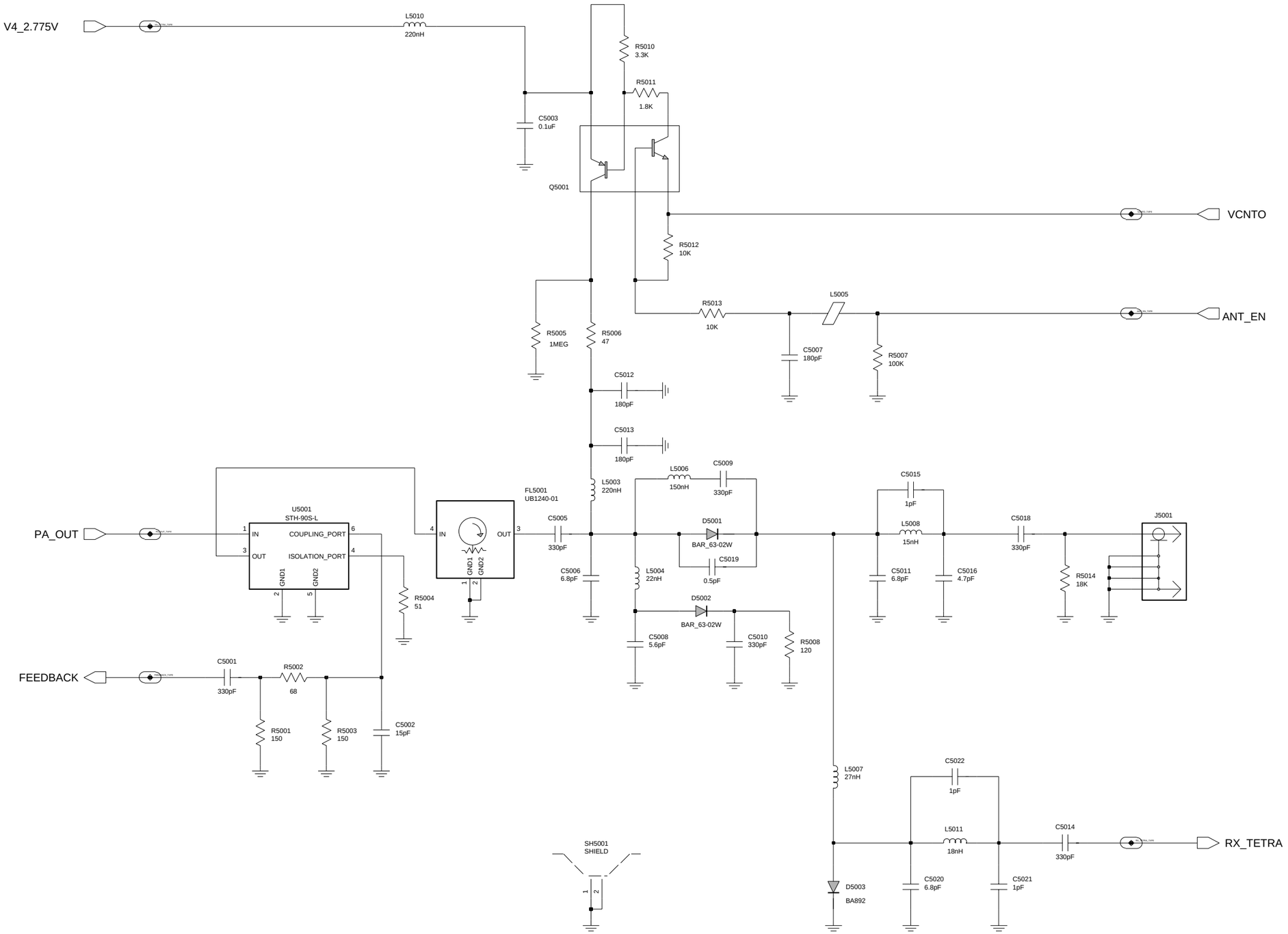
TXU Block Diagram



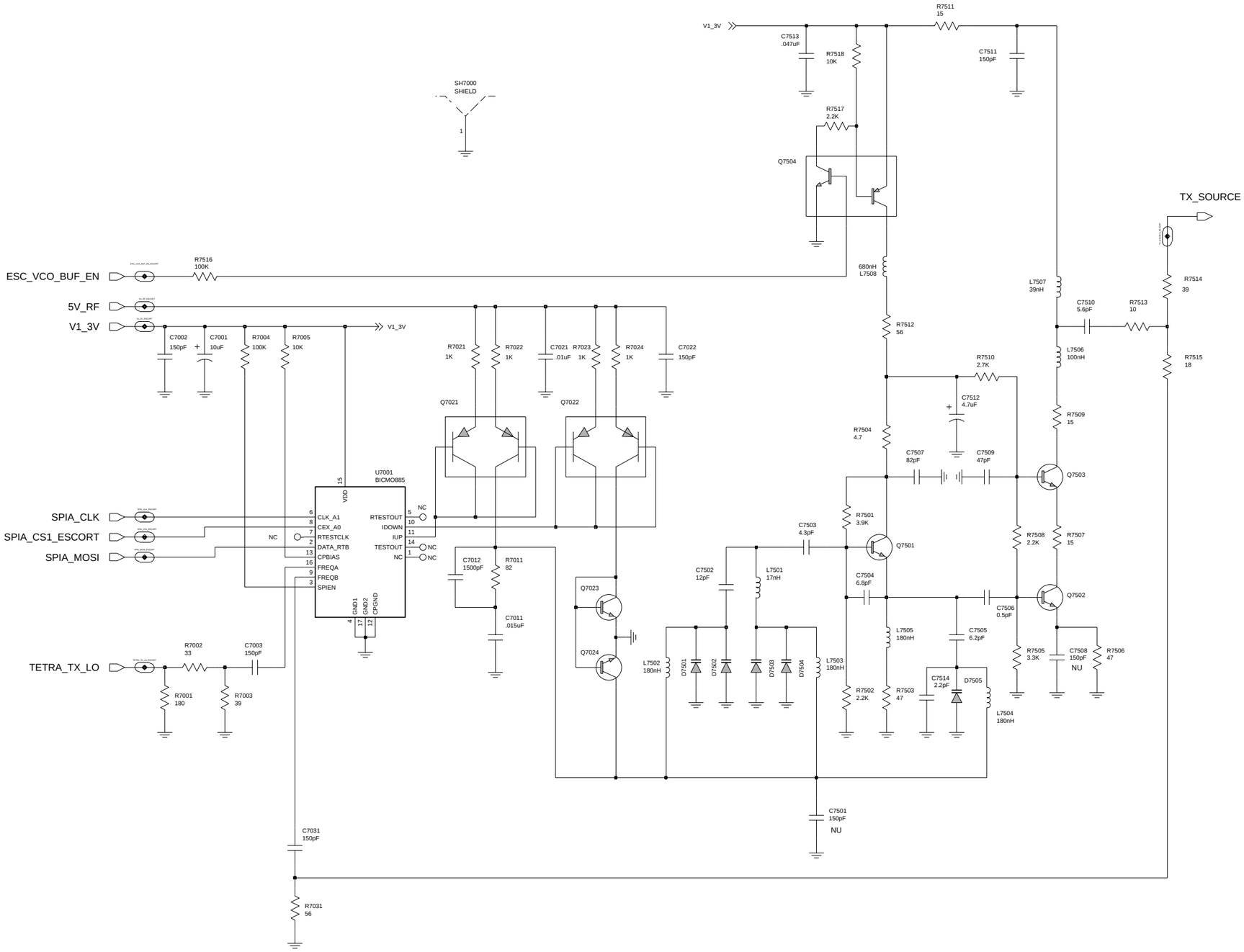
TXU-LNODCT Schematic Diagram



TXU-TX Power Amplifier Schematic Diagram



TXU-TX Front End Schematic Diagram



TXU-ESCORT/TX VCO Schematic Diagram

380-430 MHz Radio Parts List

Circuit Ref	Motorola Part No.	Description
C1001	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C1002	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C1003	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C1004	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C1005	2113743L29	Cap Cer Chip 3300pF 10% 16V X7R 0402
C1006	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C1007	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C1008	2113741A49	Cap Cer Chip 15000pF 5% 50V X7R 0805
C1009	2113743L41	Cap Cer Chip 10000pF 10% 16V X7R 0402
C1010	2113743L17	Cap Cer Chip 1000pF 10% 16V X7R 0402
C1011	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C1012	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C1013	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C1014	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C1015	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C1016	2113743L03	Cap Cer Chip 270pF 10% 16V X7R 0402
C1017	2113928C04	Cap Cer Chip 4.7uF 10% 6.3V X5R 0805
C1018	2113743L41	Cap Cer Chip 10000pF 10% 16V X7R 0402
C1019	2113743L41	Cap Cer Chip 10000pF 10% 16V X7R 0402
C1020	2113743L01	Cap Cer Chip 220pF 10% 16V X7R 0402
C1021	2113928C04	Cap Cer Chip 4.7uF 10% 6.3V X5R 0805
C1022	2113743L03	Cap Cer Chip 270pF 10% 16V X7R 0402
C1301	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C1302	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C1501	2113743L17	Cap Cer Chip 1000pF 10% 16V X7R 0402
C1502	2113743L17	Cap Cer Chip 1000pF 10% 16V X7R 0402
C1504	2113743L03	Cap Cer Chip 270pF 10% 16V X7R 0402
C1505	2113743N34	Cap Cer Chip 22.0pF 5% 16V COG 0402
C1506	2113743L05	Cap Cer Chip 330pF 10% 16V X7R 0402
C1511	2113743L50	Cap Cer Chip 33000pF 10% 16V X7R 0402
C1512	2113743L33	Cap Cer Chip 4700pF 10% 16V X7R 0402
C1521	2113743N21	Cap Cer Chip 6.2pF +/-0.5pF 16V COG 0402
C1522	2113743N16	Cap Cer Chip 3.9pF +/-0.25pF 16V COG 0402
C1523	2113743N24	Cap Cer Chip 8.2pF +/-0.5pF 16V COG 0402
C1524	2113743N26	Cap Cer Chip 10.0pF 5% 16V COG 0402
C1525	2113743N26	Cap Cer Chip 10.0pF 5% 16V COG 0402
C1526	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C1527	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C1541	2113743L05	Cap Cer Chip 330pF 10% 16V X7R 0402
C1542	2113743N28	Cap Cer Chip 12.0pF 5% 16V COG 0402
C1543	2113743N30	Cap Cer Chip 15.0pF 5% 16V COG 0402
C1544	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C1801	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C1802	2113928K09	Cap Cer Chip 10.0uF 10% 6.3V X5R 1206
C1803	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C1804	2113743N38	Cap Cer Chip 33.0pF 5% 16V COG 0402
C1805	2113928K09	Cap Cer Chip 10.0uF 10% 6.3V X5R 1206
C1806	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C1807	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C1808	Not Placed	GCAM Dummy Part Number
C1809	2113743L29	Cap Cer Chip 3300pF 10% 16V X7R 0402
C1810	2113743L48	Cap Cer Chip 22000pF 10% 16V X7R 0402
C1811	0885126C07	Cap 0.1uF Poly
C1812	Not Placed	GCAM Dummy Part Number
C1815	2113743L29	Cap Cer Chip 3300pF 10% 16V X7R 0402
C1816	2113743N50	Cap Cer Chip 100pF 5% 16V COG 0402
C1817	2113743L17	Cap Cer Chip 1000pF 10% 16V X7R 0402
C1820	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
D1521	4809877C13	Diode Varactor ISV305 ESC
L1001	2462587V38	Ind Chip 220nH 5% 0805
L1002	2462587V38	Ind Chip 220nH 5% 0805
L1521	2413926G15	Ind Cer Chip 47.0nH 5% 0603
L1522	2409134J04	Ind Chip Fer Fltr 600 0603
L1541	2413926G15	Ind Cer Chip 47.0nH 5% 0603
Q1521	4805793Y01	Trans Mini Sot NPN NE68519
Q1531	4805723X03	Trans Dual NPN-PNP UMD3N
R1001	0662057U85	Res Chip 2.2k 1% 0.063W 0402
R1002	0662057U39	Res Chip 33 1% 0.063W 0402
R1003	0662057N23	Res Chip 100k 5% 0.063W 0402
R1004	0662057N23	Res Chip 100k 5% 0.063W 0402
R1005	0662057N23	Res Chip 100k 5% 0.063W 0402
R1301	0662057M78	Res Chip 1500 5% 0.063W 0402
R1511	0662057M90	Res Chip 4700 5% 0.063W 0402
R1512	0662057U85	Res Chip 2.2k 1% 0.063W 0402
R1521	0662057M98	Res Chip 10k 5% 0.063W 0402
R1522	0662057M60	Res Chip 270 5% 0.063W 0402
R1523	0662057M90	Res Chip 4700 5% 0.063W 0402
R1524	0662057M50	Res Chip 100 5% 0.063W 0402
R1802	0662057M54	Res Chip 150 5% 0.063W 0402
R1803	0662057M58	Res Chip 220 5% 0.063W 0402
R1804	0662057U39	Res Chip 33 1% 0.063W 0402
R1805	0662057M74	Res Chip 1000 5% 0.063W 0402
R1807	0662057M90	Res Chip 4700 5% 0.063W 0402
R1810	0662057U39	Res Chip 33 1% 0.063W 0402
SH1000	2666510A02	Shield, RFCU - WPI
SH1500	2686118Z01	Primary Shield, 2ND LO
U1001	5185368C21	WPIC Plus
U1501	5186226J12	LMX2332
Y1301	5102463J73	KT19 16.8MHz TCXO 1ppm
C2001	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C2002	2113928K09	Cap Cer Chip 10.0uF 10% 6.3V X5R 1206
C2100	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C2101	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C2200	2113743N28	Cap Cer Chip 12.0pF 5% 16V COG 0402
C2201	2113743N30	Cap Cer Chip 15.0pF 5% 16V COG 0402
C2202	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C2203	2113743L17	Cap Cer Chip 1000pF 10% 16V X7R 0402
C2204	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C2205	2113743N38	Cap Cer Chip 33.0pF 5% 16V COG 0402
C2206	2113743L17	Cap Cer Chip 1000pF 10% 16V X7R 0402
C2207	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C2208	2113743L17	Cap Cer Chip 1000pF 10% 16V X7R 0402
C2209	2113740F09	Cap Cer Chip 1.8pF+/-0.1pF NPO 50V 0603
C2210	2113740L02	Cap Cer Chip 2.2pF +/-0.1pF NPO 50V 0603
C2300	2113740L11	Cap Cer Chip 5.1pF +/-0.1pF NPO 50V 0603
C2301	2113740F02	Cap Cer Chip 0.75pF+/-0.1pF NPO 50V 0603
C2302	2113740L17	Cap Cer Chip 9.1pF +/-0.1pF NPO 50V 0603
C2303	2113740L09	Cap Cer Chip 4.3pF +/-0.1pF NPO 50V 0603
C2304	2113740L17	Cap Cer Chip 9.1pF +/-0.1pF NPO 50V 0603
C2305	2113740L05	Cap Cer Chip 3.0pF +/-0.1pF NPO 50V 0603
C2306	2113740L11	Cap Cer Chip 5.1pF +/-0.1pF NPO 50V 0603
C2400	2113740L40	Cap Cer Chip 82.0pF 2% NPO 50V 0603
C2401	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C2402	2113740L20	Cap Cer Chip 12.0pF 2% NPO 50V 0603
C2403	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C2404	2113743L17	Cap Cer Chip 1000pF 10% 16V X7R 0402
C2405	2113740L20	Cap Cer Chip 12.0pF 2% NPO 50V 0603
C2406	2113741F41	Cap Cer Chip 4700pF 5% 50V X7R 0603

Circuit Ref	Motorola Part No.	Description
C2407	2113743L17	Cap Cer Chip 1000pF 10% 16V X7R 0402
C2408	2113743N38	Cap Cer Chip 33.0pF 5% 16V COG 0402
C2500	2113740L02	Cap Cer Chip 2.2pF +/-0.1pF NPO 50V 0603
C2501	2113740L02	Cap Cer Chip 2.2pF +/-0.1pF NPO 50V 0603
C2502	2113740L02	Cap Cer Chip 2.2pF +/-0.1pF NPO 50V 0603
C2503	2113740L12	Cap Cer Chip 5.6pF +/-0.1pF NPO 50V 0603
C2504	2113740L18	Cap Cer Chip 10.0pF +/-0.25pF NPO 50V 0603
C2505	2113740L18	Cap Cer Chip 10.0pF +/-0.25pF NPO 50V 0603
C2506	2113740L34	Cap Cer Chip 47.0pF 2% NPO 50V 0603
D2100	4813825A19	Diode Schottky Barrier Series
E2100	2480640Z01	C/IND BK1005HM471 Bead
E2200	2480640Z01	C/IND BK1005HM471 Bead
E2400	2480640Z01	C/IND BK1005HM471 Bead
FL2100	9166508A01	Tuneable Chip Multilayer LC Filter
FL2500	9186323Z01	FLTR 3 POL SURF MT XTAL 109.65MHz TOYOCOM
L2001	2409377M36	Ind Chip WW 220nH 5% 0603
L2200	2409377M06	Ind Chip WW 15nH 5% 0603
L2201	2462587V30	Ind Chip 47nH 5% 0805
L2202	2462587V28	Ind Chip 33nH 5% 0805
L2300	2413923B15	Ind Chip 22nH 2% 805CS
L2301	2413923B24	Ind Chip 15nH 2% 805CS
L2302	2413923B24	Ind Chip 15nH 2% 805CS
L2400	2462587V30	Ind Chip 47nH 5% 0805
L2401	2462587V30	Ind Chip 47nH 5% 0805
L2402	2462587V23	Ind Chip 12nH 5% 0805
L2403	2462587V23	Ind Chip 12nH 5% 0805
L2500	2413926K31	Ind Cer Chip 470nH 5% 0805
L2501	2413926K31	Ind Cer Chip 470nH 5% 0805
L2502	2409377M36	Ind Chip WW 220nH 5% 0603
L2503	2409377M36	Ind Chip WW 220nH 5% 0603
Q2200	4805723X03	Trans Dual NPN-PNP UMD3N
Q2400	4809939C06	Tstr Dual PNP/NPN UMZ2N
R2200	0662057M26	Res Chip 10 5% 0.063W 0402
R2201	0662057M74	Res Chip 1000 5% 0.063W 0402
R2202	0662057M72	Res Chip 820 5% 0.063W 0402
R2400	0662057M62	Res Chip 330 5% 0.063W 0402
R2401	0662057U31	Res Chip 15 1% 0.063W 0402
R2402	0662057M62	Res Chip 330 5% 0.063W 0402
R2403	0662057M68	Res Chip 560 5% 0.063W 0402
R2404	0662057M62	Res Chip 330 5% 0.063W 0402
R2405	0662057U31	Res Chip 15 1% 0.063W 0402
R2406	0662057M62	Res Chip 330 5% 0.063W 0402
R2407	0662057M80	Res Chip 1800 5% 0.063W 0402
R2408	0662057U89	Res Chip 3.3k 1% 0.063W 0402
R2409	0662057U89	Res Chip 3.3k 1% 0.063W 0402
R2410	0662057M80	Res Chip 1800 5% 0.063W 0402
SH2001	2666513A02	Shield, RXU - IF
SH2002	2666512A02	Shield, RXU - RF
U2200	5185368C01	IC 3V Low Noise AMP RC2361
U2400	5108428S91	Linear Mixer CMY211
C3001	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C3002	2113740F51	Cap Cer Chip 100pF 5% NPO 50V 0603
C3003	2113743N53	Cap Cer Chip 130pF 5% 16V COG 0402
C3005	2104801Z32	Cap Cer Chip 15.0pF 2% HF16V 0402
C3006	2104801Z10	Cap Cer Chip 1.5pF +/-0.1pF HF16V 0402
C3007	2104801Z32	Cap Cer Chip 15.0pF 2% HF16V 0402
C3008	2104801Z27	Cap Cer Chip 7.5pF +/-0.25pF HF16V 0402
C3009	2104801Z31	Cap Cer Chip 12.0pF +/-0.25pF HF16V 0402
C3011	2104801Z28	Cap Cer Chip 8.2pF +/-0.25pF HF16V 0402
C3012	2104801Z26	Cap Cer Chip 6.8pF +/-0.25pF HF16V 0402
C3013	2113740F51	Cap Cer Chip 100pF 5% NPO 50V 0603
C3014	2113743N53	Cap Cer Chip 130pF 5% 16V COG 0402
C3015	2104801Z30	Cap Cer Chip 0.75pF +/-0.1pF HF16V 0402
C3016	2113743N53	Cap Cer Chip 130pF 5% 16V COG 0402
C3017	2113743N53	Cap Cer Chip 130pF 5% 16V COG 0402
C3018	2113743N10	Cap Cer Chip 2.2pF +/-0.25pF 16V COG 0402
C3019	2104801Z32	Cap Cer Chip 15.0pF 2% HF16V 0402
C3020	2104801Z32	Cap Cer Chip 15.0pF 2% HF16V 0402
C3021	2113743N53	Cap Cer Chip 130pF 5% 16V COG 0402
C3022	2113743N14	Cap Cer Chip 3.3pF +/-0.25pF 16V COG 0402
C3023	Not Placed	GCAM Dummy Part Number
C3024	2104801Z32	Cap Cer Chip 15.0pF 2% HF16V 0402
C3025	2104801Z32	Cap Cer Chip 15.0pF 2% HF16V 0402
C3026	2311049A59	Cap Tant Chip 10uF 10% 6V A
C3028	2113743L48	Cap Cer Chip 22000pF 10% 16V X7R 0402
C3029	2113743L48	Cap Cer Chip 22000pF 10% 16V X7R 0402
D3001	4809877C13	Diode Varactor ISV305 ESC
D3002	4809877C13	Diode Varactor ISV305 ESC
D3003	4809877C13	Diode Varactor ISV305 ESC
E3001	2409134J04	Ind Chip Fer Fltr 600 0603
L3001	2462587V41	Ind Chip 390nH 10% 0805
L3002	2462587V41	Ind Chip 390nH 10% 0805
L3003	2462587V41	Ind Chip 390nH 10% 0805
L3004	2462587V41	Ind Chip 390nH 10% 0805
L3005	2462587V22	Ind Chip 8.2nH 5% 0805
L3006	2462587V22	Ind Chip 8.2nH 5% 0805
Q3001	4809939C06	Tstr Dual PNP/NPN UMZ2N
Q3002	4805793Y01	Trans Mini SOT NPN NE68519
Q3003	4805793Y01	Trans Mini SOT NPN NE68519
Q3004	4805793Y01	Trans Mini SOT NPN NE68519
R3001	0662057N33	Res Chip 270k 5% 0.063W 0402
R3002	0662057N23	Res Chip 100k 5% 0.063W 0402
R3003	Not Placed	GCAM Dummy Part Number
R3004	0662057U85	Res Chip 2.2k 1% 0.063W 0402
R3005	0662057M98	Res Chip 10k 5% 0.063W 0402
R3006	0662057M18	Res Chip 4.7 5% 0.063W 0402
R3007	0662057U87	Res Chip 2.7k 1% 0.063W 0402
R3008	0662057M98	Res Chip 10k 5% 0.063W 0402
R3009	0662057M01	Res Chip 0 5% 0.063W 0402
R3010	0662057M62	Res Chip 330 5% 0.063W 0402
R3013	0662057M41	Res Chip 43 5% 0.063W 0402
R3014	0662057N07	Res Chip 22k 5% 0.063W 0402
R3015	0662057M41	Res Chip 43 5% 0.063W 0402
R3016	0662057N07	Res Chip 22k 5% 0.063W 0402
R3017	0662057M34	Res Chip 22 5% 0.063W 0402
R3018	0662057M34	Res Chip 22 5% 0.063W 0402
SH3001	2666514A02	Shield, Main VCO
Y3001	4805911Z14	Ind Coaxial Ceramic 1100 MHz
C4001	2113743L48	Cap Cer Chip 22000pF 10% 16V X7R 0402
C4003	2113743P01	Cap Cer Chip 180pF 5% 16V COH 0402
C4005	2113743L05	Cap Cer Chip 330pF 10% 16V X7R 0402
C4006	2113743L48	Cap Cer Chip 22000pF 10% 16V X7R 0402
C4007	2113743L48	Cap Cer Chip 22000pF 10% 16V X7R 0402
C4008	2113743L05	Cap Cer Chip 330pF 10% 16V X7R 0402
C4009	2113743N30	Cap Cer Chip 15.0pF 5% 16V COG 0402
C4011	2113743M24	Cap Cer Chip 0.1uF +80/-20% 16V Y5V 0402
C4012	2113743L48	Cap Cer Chip 22000pF 10% 16V X7R 0402
C4013	2113743L05	Cap Cer Chip 330pF 10% 16V X7R 0402
C4014	2113743L05	Cap Cer Chip 330pF 10% 16V X7R 0402
C4015	2113740L20	Cap Cer Chip 12.0pF 2% NPO 50V 0603
C4018	2113743P01	Cap Cer Chip 180pF 5% 16V COH 0402
C4019	2113740F61	Cap Cer Chip 270pF 5% NPO 50V 0603
C4020	2113743P01	Cap Cer Chip 180pF 5% 16V COH 0402
C4021	2113743L17	Cap Cer Chip 1000pF 10% 16V X7R 0402
C4022	2113743P01	Cap Cer Chip 180pF 5% 16V COH 0402
C4024	2113740L28	Cap Cer Chip 27.0pF 2% NPO 50V 0603
C4026	2113743P01	Cap Cer Chip 180pF 5% 16V COH 0402
C4028	2113740L34	Cap Cer Chip 47.0pF 2% NPO 50V 0603
C4030	2113743F16	Cap Cer Chip 1.0uF +80/-20% 16V Y5V 0805
C4031	Not Placed	GCAM Dummy Part Number
C4033	2113740L18	Cap Cer Chip 10.0pF +/-0.25pF NPO 50V 0603
C4035	2311049C49	Cap Tant Chip 100uF 10% 16V D
C4036	2311049C49	Cap Tant Chip 100uF 10% 16V D
C4037	2311049C49	Cap Tant Chip 100uF 10% 16V D
C4042	2113740L28	Cap Cer Chip 27.0pF 2% NPO 50V 0603
C4043	2113740L28	Cap Cer Chip 27.0pF 2% NPO 50V 0603
C4050	2113743P01	Cap Cer Chip 180pF 5% 16V COH 0402
C4051	Not Placed	GCAM Dummy Part Number
C4052	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C4100	2113743P01	Cap Cer Chip 180pF 5% 16V COH 0402
C4101	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402

Circuit Ref	Motorola Part No.	Description
E4002	7608671Y02	Ferrite Bead 500 OHM SMD Pkg
L4003	2413926N29	Ind Cer Chip 270nH 5% 0603
L4005	2413926N29	Ind Cer Chip 270nH 5% 0603
L4006	2409377M14	Ind Chip WW 68nH 5% 0603
L4007	2409377M05	Ind Chip WW 12nH 5% 0603
L4008	2462587V64	Ind Chip 5.6nH 5% 0805
L4009	2409414M37	Ind Chip WW 18nH 10% 0805
L4010	2462587V64	Ind Chip 5.6nH 5% 0805
L4011	2409377M17	Ind Chip WW 100nH 5% 0603
L4100	2413926N29	Ind Cer Chip 270nH 5% 0603
M4001	2680499Z01	Heat Spreader
Q4001	4813828A09	Tstr 8W 450MHZ 7.5V MRF1517
Q4100	4809939C05	Tstr Dual NPN/PNP UMH 5
R4001	0662057M98	Res Chip 10k 5% 0.063W 0402
R4002	0662057M57	Res Chip 200 5% 0.063W 0402
R4003	0662057N07	Res Chip 22k 5% 0.063W 0402
R4004	0662057A13	Res Chip 33 5% 0.1W 0603
R4005	0662057A13	Res Chip 33 5% 0.1W 0603
R4006	0662057M57	Res Chip 200 5% 0.063W 0402
R4007	0662057M50	Res Chip 100 5% 0.063W 0402
R4008	0662057B55	Res Chip 2.0 5% 0.1W 0603
R4009	0662057M26	Res Chip 10 5% 0.063W 0402
R4010	0662057A13	Res Chip 33 5% 0.1W 0603
R4012	0662057N07	Res Chip 22k 5% 0.063W 0402
R4016	0662057M57	Res Chip 200 5% 0.063W 0402
R4018	0662057M98	Res Chip 10k 5% 0.063W 0402
R4100	Not Placed	GCAM Dummy Part Number
R4101	0662057M01	Res Chip 0 5% 0.063W 0402
R4102	Not Placed	GCAM Dummy Part Number
RT4001	0686931J01	Thermistor 47k
SH4001	2666515A02	Shield, TXPA - Driver
SH4002	2666516A03	Shield, TXPA - PA
U4001	5185130C65	IC VHF/UHF/800 MHZ LDMOS Driver 30C65
U4002	5162852A09	Low Pwr OP AMP LMC7101BI
U4100	5162852A09	Low Pwr OP AMP LMC7101BI
U4102	5102463J79	MAX5401 Low-Drift Digital Potentiometer
C5001	2113743L05	Cap Cer Chip 330pF 10% 16V X7R 0402
C5002	2113743N30	Cap Cer Chip 15.0pF 5% 16V COG 0402
C5003	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C5005	2113740F63	Cap Cer Chip 330pF 5% NPO 50V 0603
C5006	2113740L14	Cap Cer Chip 6.8pF +/-0.1pF NPO 50V 0603
C5007	2113743P01	Cap Cer Chip 180pF 5% 16V COH 0402

Circuit Ref	Motorola Part No.	Description
C5008	2113740L12	Cap Cer Chip 5.6pF +/-0.1pF NPO 50V 0603
C5009	2113740F63	Cap Cer Chip 330pF 5% NPO 50V 0603
C5010	2113740F63	Cap Cer Chip 330pF 5% NPO 50V 0603
C5011	2113740L14	Cap Cer Chip 6.8pF +/-0.1pF NPO 50V 0603
C5012	2113740F57	Cap Cer Chip 180pF 5% NPO 50V 0603
C5013	2113740F57	Cap Cer Chip 180pF 5% NPO 50V 0603
C5014	2113740F63	Cap Cer Chip 330pF 5% NPO 50V 0603
C5015	2113740F03	Cap Cer Chip 1.0pF+/-0.1pF NPO 50V 0603
C5016	2113740L10	Cap Cer Chip 4.7pF +/-0.1pF NPO 50V 0603
C5018	2113740F63	Cap Cer Chip 330pF 5% NPO 50V 0603
C5019	2113740F01	Cap Cer Chip 0.5pF+/-0.1pF NPO 50V 0603
C5020	2113740L14	Cap Cer Chip 6.8pF +/-0.1pF NPO 50V 0603
C5021	2113740F03	Cap Cer Chip 1.0pF+/-0.1pF NPO 50V 0603
C5022	2113740F03	Cap Cer Chip 1.0pF+/-0.1pF NPO 50V 0603
D5001	4809948D12	Diode RF Switch BAR63-02W
D5002	4809948D12	Diode RF Switch BAR63-02W
D5003	4809948D13	Diode RF Switch BA892 ESC
FL5001	5804901K14	380-430 MHZ ISOLATOR
J5001	2880658Z03	Connector (SMA)
L5003	2462587V38	IND CHIP 220nH 5% 0805
L5004	2462587V26	IND CHIP 22nH 5% 0805
L5005	7686949J02	Ferrite Bead Chip-0402 SIZE
L5006	2409414M31	IND CHIP WW 150nH 2% 0805
L5007	2462587V27	IND CHIP 27nH 5% 0805
L5008	2462587V24	IND CHIP 15nH 5% 0805
L5010	2462587V38	IND CHIP 220nH 5% 0805
L5011	2462587V25	IND CHIP 18nH 5% 0805
Q5001	4809939C06	Tstr Dual PNP/NPN UMZ2N
R5001	0662057M54	Res Chip 150 5% 0.063W 0402
R5002	0662057M46	Res Chip 68 5% 0.063W 0402
R5003	0662057M54	Res Chip 150 5% 0.063W 0402
R5004	0662057A18	Res Chip 51 5% 0.1W 0603
R5005	0662057N47	Res Chip 1M 5% 0.063W 0402
R5006	0662057U43	Res Chip 47 1% 0.063W 0402
R5007	0662057N23	Res Chip 100k 5% 0.063W 0402
R5008	0662057M52	Res Chip 120 5% 0.063W 0402
R5010	0662057U89	Res Chip 3.3k 1% 0.063W 0402

Circuit Ref	Motorola Part No.	Description
R5011	0662057M80	Res Chip 1800 5% 0.063W 0402
R5012	0662057M98	Res Chip 10k 5% 0.063W 0402
R5013	0662057M98	Res Chip 10k 5% 0.063W 0402
R5014	0662057A79	Res Chip 18k 5% 0.1W 0603
SH5001	2666517A02	Shield, TXFE - ANT Switch
U5001	5866504A01	400/500MHZ Band Chip Direct Coupler
C6001	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C6002	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C6003	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C6004	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C6005	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C6006	2113740L24	Cap Cer Chip 18.0pF 2% NPO 50V 0603
C6007	2113740L22	Cap Cer Chip 15.0pF 2% NPO 50V 0603
C6008	2113740L12	Cap Cer Chip 5.6pF +/-0.1pF NPO 50V 0603
C6009	2113740L04	Cap Cer Chip 2.7pF +/-0.1pF NPO 50V 0603
C6010	2113740L12	Cap Cer Chip 5.6pF +/-0.1pF NPO 50V 0603
C6011	2113740L22	Cap Cer Chip 15.0pF 2% NPO 50V 0603
C6012	2113740L24	Cap Cer Chip 18.0pF 2% NPO 50V 0603
C6013	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C6014	2113743N11	Cap Cer Chip 2.4pF +/-0.25pF 16V COG 0402
C6015	2113743N11	Cap Cer Chip 2.4pF +/-0.25pF 16V COG 0402
C6016	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C6017	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C6018	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C6019	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C6020	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C6021	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C6022	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402

Circuit Ref	Motorola Part No.	Description
C6023	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C6024	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C6025	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C6026	2113928K09	Cap Cer Chip 10.0uF 10% 6.3V X5R 1206
C6027	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C6029	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C6030	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C6031	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C6032	2113743N07	Cap Cer Chip 1.5pF +/-0.25pF 16V COG 0402
C6033	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C6034	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C6035	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C6036	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C6037	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C6038	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C6039	2113743E07	Cap Cer Chip .022uF 10% 16V X7R 0603
C6040	2113741F45	Cap Cer Chip 6800pF 5% 50V X7R 0603
C6041	2113743E03	Cap Cer Chip .015uF 10% 16V X7R 0603
C6042	2113743E03	Cap Cer Chip .015uF 10% 16V X7R 0603
C6043	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C6044	2113743E05	Cap Cer Chip .018uF 10% 16V X7R 0603
C6045	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C6046	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C6047	2113743E05	Cap Cer Chip .018uF 10% 16V X7R 0603
C6048	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402

Circuit Ref	Motorola Part No.	Description
C6049	2113741F41	Cap Cer Chip 4700pF 5% 50V X7R 0603
C6050	2113741F41	Cap Cer Chip 4700pF 5% 50V X7R 0603
C6051	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C6052	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C6053	2113740L22	Cap Cer Chip 15.0pF 2% NPO 50V 0603
C6055	2113743N17	Cap Cer Chip 4.3pF +/-0.25pF 16V COG 0402
C6056	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C6057	2113743N12	Cap Cer Chip 2.7pF +/-0.25pF 16V COG 0402
E6001	2409134J04	Ind Chip Fer Fltr 600 0603
E6002	2409134J04	Ind Chip Fer Fltr 600 0603
L6002	2409377M17	Ind Chip WW 100nH 5% 0603
L6003	2413923B23	Ind Chip 12nH 2% 805CS
L6004	2413923B23	Ind Chip 12nH 2% 805CS
L6005	2409377M17	Ind Chip WW 100nH 5% 0603
L6006	2409377M17	Ind Chip WW 100nH 5% 0603
L6008	Not Placed	GCAM Dummy Part Number
L6009	2409154M20	Ind Cer Chip 39nH 5% 0402
Q6001	4802197J95	TSTR NPN PBR941
Q6002	4809939C06	TSTR Dual PNP/NPN UMZ2N
R6001	0662057M40	Res Chip 39 5% 0.063W 0402
R6002	0662057M54	Res Chip 150 5% 0.063W 0402
R6003	0662057M54	Res Chip 150 5% 0.063W 0402
R6004	0662057M46	Res Chip 68 5% 0.063W 0402
R6005	0662057M62	Res Chip 330 5% 0.063W 0402
R6006	0662057M66	Res Chip 470 5% 0.063W 0402
R6008	0662057U31	Res Chip 15 1% 0.063W 0402
R6009	0662057U31	Res Chip 15 1% 0.063W 0402
R6010	0662057U31	Res Chip 15 1% 0.063W 0402
R6011	0662057M44	Res Chip 56 5% 0.063W 0402
R6012	0662057M44	Res Chip 56 5% 0.063W 0402
R6013	0662057M44	Res Chip 56 5% 0.063W 0402
R6014	0662057M58	Res Chip 220 5% 0.063W 0402
R6015	0662057M74	Res Chip 1000 5% 0.063W 0402
R6016	0662057M98	Res Chip 10k 5% 0.063W 0402
R6017	0662057M66	Res Chip 470 5% 0.063W 0402
R6018	0662057M98	Res Chip 10k 5% 0.063W 0402
R6019	0662057M74	Res Chip 1000 5% 0.063W 0402
R6020	0662057U39	Res Chip 33 1% 0.063W 0402
R6021	0662057U39	Res Chip 33 1% 0.063W 0402
R6022	0662057U39	Res Chip 33 1% 0.063W 0402
R6023	0662057U39	Res Chip 33 1% 0.063W 0402
R6024	0662057M74	Res Chip 1000 5% 0.063W 0402
R6025	0662057M18	Res Chip 4.7 5% 0.063W 0402

Circuit Ref	Motorola Part No.	Description
R6026	0662057M74	Res Chip 1000 5% 0.063W 0402
R6029	Not Placed	GCAM Dummy Part Number
SH6001	2666518A02	Shield, TXU - LNODCT2
SH6002	2666519A02	Shield, TXU - LNODCT
T6001	2580443L04	Transformer BALUN
U6001	5880334L02	450MHZ 90 Deg Splitter
U6002	5108428S43	Low Noise ODCT
C7001	2311049A59	CAP TANT CHIP 10uF 10% 6V A
C7002	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C7003	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C7011	2113743E03	Cap Cer Chip .015uF 10% 16V X7R 0603
C7012	2113743L21	Cap Cer Chip 1500pF 10% 16V X7R 0402
C7021	2113743L41	Cap Cer Chip 10000pF 10% 16V X7R 0402
C7022	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C7031	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C7501	Not Placed	GCAM Dummy Part Number
C7502	2113740L20	Cap Cer Chip 12.0pF 2% NPO 50V 0603
C7503	2113740L09	Cap Cer Chip 4.3pF +/-0.1pF NPO 50V 0603
C7504	2113740L14	Cap Cer Chip 6.8pF +/-0.1pF NPO 50V 0603
C7505	2113740L13	Cap Cer Chip 6.2pF +/-0.1pF NPO 50V 0603
C7506	2113740F01	Cap Cer Chip 0.5pF+/-0.1pF NPO 50V 0603
C7507	2113743N48	Cap Cer Chip 82.0pF 5% 16V COG 0402
C7508	Not Placed	GCAM Dummy Part Number
C7509	2113743N42	Cap Cer Chip 47.0pF 5% 16V COG 0402
C7510	2113740L12	Cap Cer Chip 5.6pF +/-0.1pF NPO 50V 0603
C7511	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C7512	2311049C18	CAP TANT CHIP 4.7uF 10% 6V LP(A)
C7513	2113743E12	Cap Cer Chip .047uF 10% 16V X7R 0603
C7514	2113740L02	Cap Cer Chip 2.2pF +/-0.1pF NPO 50V 0603
D7501	4809877C13	Diode Varactor ISV305 ESC
D7502	4809877C13	Diode Varactor ISV305 ESC
D7503	4862824C01	Diode Varactor 1SV229 USC

Circuit Ref	Motorola Part No.	Description
D7504	4862824C01	Diode Varactor 1SV229 USC
D7505	4809877C13	Diode Varactor ISV305 ESC
L7501	2462587W03	Ind Chip 17nH 5% 1206
L7502	2462587V18	Ind Chip 180nH 10% 0805
L7503	2462587V18	Ind Chip 180nH 10% 0805
L7504	2462587V18	Ind Chip 180nH 10% 0805
L7505	2462587V18	Ind Chip 180nH 10% 0805
L7506	2462587V34	Ind Chip 100nH 5% 0805
L7507	2462587V29	Ind Chip 39nH 5% 0805
L7508	2462587V44	Ind Chip 680nH 10% 0805
Q7021	4805723X02	Trans Dual PNP UMT1N
Q7022	4805723X02	Trans Dual PNP UMT1N
Q7023	4805793Y01	Trans Mini SOT NPN NE68519
Q7024	4805793Y01	Trans Mini SOT NPN NE68519
Q7501	4805793Y01	Trans Mini SOT NPN NE68519
Q7502	4805793Y01	Trans Mini SOT NPN NE68519
Q7503	4805793Y01	Trans Mini SOT NPN NE68519
Q7504	4809939C06	Tstr Dual PNP/NPN UMZ2N
R7001	0662057M56	Res Chip 180 5% 0.063W 0402
R7002	0662057U39	Res Chip 33 1% 0.063W 0402
R7003	0662057M40	Res Chip 39 5% 0.063W 0402
R7004	0662057N23	Res Chip 100k 5% 0.063W 0402
R7005	0662057M98	Res Chip 10k 5% 0.063W 0402
R7011	0662057M48	Res Chip 82 5% 0.063W 0402
R7021	0662057M74	Res Chip 1000 5% 0.063W 0402
R7022	0662057M74	Res Chip 1000 5% 0.063W 0402
R7023	0662057M74	Res Chip 1000 5% 0.063W 0402
R7024	0662057M74	Res Chip 1000 5% 0.063W 0402
R7031	0662057M44	Res Chip 56 5% 0.063W 0402
R7501	0662057U91	Res Chip 3.9k 1% 0.063W 0402
R7502	0662057U85	Res Chip 2.2k 1% 0.063W 0402
R7503	0662057U43	Res Chip 47 1% 0.063W 0402
R7504	0662057M18	Res Chip 4.7 5% 0.063W 0402
R7505	0662057U89	Res Chip 3.3k 1% 0.063W 0402
R7506	0662057U43	Res Chip 47 1% 0.063W 0402
R7507	0662057U31	Res Chip 15 1% 0.063W 0402
R7508	0662057U85	Res Chip 2.2k 1% 0.063W 0402
R7509	0662057U31	Res Chip 15 1% 0.063W 0402
R7510	0662057U87	Res Chip 2.7k 1% 0.063W 0402
R7511	0662057U31	Res Chip 15 1% 0.063W 0402
R7512	0662057M44	Res Chip 56 5% 0.063W 0402
R7513	0662057M26	Res Chip 10 5% 0.063W 0402
R7514	0662057M40	Res Chip 39 5% 0.063W 0402
R7515	0662057M32	Res Chip 18 5% 0.063W 0402
R7516	0662057N23	Res Chip 100k 5% 0.063W 0402
R7517	0662057U85	Res Chip 2.2k 1% 0.063W 0402
R7518	0662057M98	Res Chip 10k 5% 0.063W 0402
SH7000	2666520A02	Shield, ESCORT/TXVCO
U7001	5185368C18	ESCORT IC IN 16 PIN QFN Package

Circuit Ref	Motorola Part No.	Description
C001	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C002	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C003	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C004	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C005	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C006	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C007	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C009	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C010	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C011	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C012	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C013	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C016	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C017	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C018	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C019	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C024	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C025	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C026	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C027	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C030	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C031	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C032	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C033	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C034	2113743M24	Cap Cer Chip 0.1uF +80/-20% 16V Y5V 0402

Circuit Ref	Motorola Part No.	Description
C035	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C036	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C037	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C038	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
D001	4809118D03	Led Red/Grn 2X3MM SMD LNJ123W8P0MT
E001	2486132Z01	BK20104M601 Ferrite Bead Array
E002	2486132Z01	BK20104M601 Ferrite Bead Array
J001	0986237A02	Connector (Contact Battery)
J002	0986017Z01	Connector, 24 Pin Socket
R001	0662057M74	Res Chip 1000 5% 0.063W 0402
R002	0662057M74	Res Chip 1000 5% 0.063W 0402
R003	0662057N13	Res Chip 39k 5% 0.063W 0402
R004	0662057N13	Res Chip 39k 5% 0.063W 0402
R005	0662057N13	Res Chip 39k 5% 0.063W 0402
R006	0662057N13	Res Chip 39k 5% 0.063W 0402
R007	0662057N13	Res Chip 39k 5% 0.063W 0402
R008	0662057N13	Res Chip 39k 5% 0.063W 0402
R009	0662057N13	Res Chip 39k 5% 0.063W 0402
R010	Not Placed	GCAM Dummy Part Number
S001	4080710Z07	Frequency Switch (Endless Rotation)
S002	4070354A01	Light Touch Switch-SMD
S003	4070354A01	Light Touch Switch-SMD
S004	4070354A01	Light Touch Switch-SMD
S005	4070354A01	Light Touch Switch-SMD
U001	5102463J90	NL27WZ16-Dual Buffer
U002	5102463J90	NL27WZ16-Dual Buffer
U005	9185759B01	FLTR RC Network
VR001	4805656W08	Diode 5.6V Zener Quad MMQA5V6T1
VR002	4805656W08	Diode 5.6V Zener Quad MMQA5V6T1
VR004	4805656W08	Diode 5.6V Zener Quad MMQA5V6T1
VR009	4813830C26	Diode 13V ‘H3’ MMSZ5243BT1
C100	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C101	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C102	2113743M24	Cap Cer Chip 0.1uF +80/-20% 16V Y5V 0402
C104	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402

Circuit Ref	Motorola Part No.	Description
C105	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C112	2113743N38	Cap Cer Chip 33.0pF 5% 16V COG 0402
C113	2113743N38	Cap Cer Chip 33.0pF 5% 16V COG 0402
C114	2113743M24	Cap Cer Chip 0.1uF +80/-20% 16V Y5V 0402
C115	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C116	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C117	2113743K16	Cap Cer Chip .022uF +80/-20% 16V Y5V 0603
C118	2113743L09	Cap Cer Chip 470pF 10% 16V X7R 0402
C119	2113743L09	Cap Cer Chip 470pF 10% 16V X7R 0402
C120	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C121	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C122	2186133Z01	Capacitor Array 33pF +/-10% 0805
C123	2186133Z01	Capacitor Array 33pF +/-10% 0805
C124	2186133Z01	Capacitor Array 33pF +/-10% 0805
C125	2113743M24	Cap Cer Chip 0.1uF +80/-20% 16V Y5V 0402
C126	2113743M24	Cap Cer Chip 0.1uF +80/-20% 16V Y5V 0402
C127	2113743N38	Cap Cer Chip 33.0pF 5% 16V COG 0402
C130	2113743N38	Cap Cer Chip 33.0pF 5% 16V COG 0402
C131	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C132	2113743L09	Cap Cer Chip 470pF 10% 16V X7R 0402
C133	2113743L09	Cap Cer Chip 470pF 10% 16V X7R 0402
C134	2113743L09	Cap Cer Chip 470pF 10% 16V X7R 0402
C135	2113743L09	Cap Cer Chip 470pF 10% 16V X7R 0402
C136	2113743L09	Cap Cer Chip 470pF 10% 16V X7R 0402
C137	2113743L09	Cap Cer Chip 470pF 10% 16V X7R 0402

Circuit Ref	Motorola Part No.	Description
C138	2113743L09	Cap Cer Chip 470pF 10% 16V X7R 0402
C139	2113743L09	Cap Cer Chip 470pF 10% 16V X7R 0402
D100	4802245J47	Diode Schottky Barrier RB471E
D101	4802245J47	Diode Schottky Barrier RB471E
E101	2480675U01	0805 Chip-3Amp
E102	2480675U01	0805 Chip-3Amp
E103	2409134J04	Ind Chip Fer Fltr 600 0603
E104	2409134J04	Ind Chip Fer Fltr 600 0603
E105	2409134J04	Ind Chip Fer Fltr 600 0603
E106	2480675U01	0805 Chip-3Amp
E107	2480675U01	0805 Chip-3Amp
E108	2480675U01	0805 Chip-3Amp
J100	0905505Y04	Conn ZIF Horizontal
J110	0980472U01	Connector 16 Pos Right Angle
Q100	5102463J80	FDC6330L Integrated Load Switch
Q101	5102463J80	FDC6330L Integrated Load Switch
Q102	4809939C05	Tstr Dual NPN/PNP UMH 5
Q103	4802245J54	UMG5N Digital Transistor
R100	Not Placed	GCAM Dummy Part Number
R101	0662057N13	Res Chip 39k 5% 0.063W 0402
R102	0662057N13	Res Chip 39k 5% 0.063W 0402
R103	0662057N13	Res Chip 39k 5% 0.063W 0402
R106	0662057M40	Res Chip 39 5% 0.063W 0402
R107	0662057M40	Res Chip 39 5% 0.063W 0402
R108	0662057N13	Res Chip 39k 5% 0.063W 0402
R109	0686135Z01	Current Sensor Resistor (0.1ohm)
R110	0662057M98	Res Chip 10k 5% 0.063W 0402
R111	0662057M98	Res Chip 10k 5% 0.063W 0402
R112	0662057N01	Res Chip 12k 5% 0.063W 0402
R113	0662057M95	Res Chip 7500 5% 0.063W 0402
R114	0662057N13	Res Chip 39k 5% 0.063W 0402
R115	0662057N13	Res Chip 39k 5% 0.063W 0402
R116	0662057M82	Res Chip 2200 5% 0.063W 0402
R117	0662057N13	Res Chip 39k 5% 0.063W 0402
R118	0662057N17	Res Chip 56k 5% 0.063W 0402
R119	0662057M74	Res Chip 1000 5% 0.063W 0402
R120	0662057M74	Res Chip 1000 5% 0.063W 0402
R121	0662057M40	Res Chip 39 5% 0.063W 0402
R122	0662057M50	Res Chip 100 5% 0.063W 0402
R123	0662057M74	Res Chip 1000 5% 0.063W 0402
R124	0662057M74	Res Chip 1000 5% 0.063W 0402
R125	0662057M74	Res Chip 1000 5% 0.063W 0402
R126	0662057M74	Res Chip 1000 5% 0.063W 0402
R127	0662057M74	Res Chip 1000 5% 0.063W 0402
R128	0662057M74	Res Chip 1000 5% 0.063W 0402
R129	0662057M74	Res Chip 1000 5% 0.063W 0402

Circuit Ref	Motorola Part No.	Description
R130	0662057M74	Res Chip 1000 5% 0.063W 0402
R131	0662057M74	Res Chip 1000 5% 0.063W 0402
R132	0662057M74	Res Chip 1000 5% 0.063W 0402
RV101	0686407Z01	TRANSORB Diode V5.5MLA 0603
S100	4070354A01	Light Touch Switch-SMD
U100	9185759B01	Fltr RC Network
U101	9185759B01	Fltr RC Network
U102	9185759B01	Fltr RC Network
U106	5109522E22	IC Sngl And Gate TC7S08FU
U107	5105625U75	IC CMOS Inverter TC7WU04FU
U108	5180508F01	IC NOR Gate Unbuffered TC7W02FU
U111	5162852A62	IC MAX4373T, Low Cost Mircpwr
VR100	4813830C26	Diode 13V ‘H3’ MMSZ5243BT1
VR101	4805656W08	Diode 5.6V Zener Quad MMQA5V6T1
VR102	4805656W08	Diode 5.6V Zener Quad MMQA5V6T1
VR103	4805656W08	Diode 5.6V Zener Quad MMQA5V6T1
VR104	4813830C26	Diode 13V ‘H3’ MMSZ5243BT1
VR105	4813830C26	Diode 13V ‘H3’ MMSZ5243BT1
C200	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C201	2113928K09	Cap Cer Chip 10.0uF 10% 6.3V X5R 1206
C202	2113743L41	Cap Cer Chip 10000pF 10% 16V X7R 0402
C203	2113743L17	Cap Cer Chip 1000pF 10% 16V X7R 0402
C204	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C205	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C206	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C207	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C208	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C209	2113928C04	Cap Cer Chip 4.7uF 10% 6.3V X5R 0805
C210	2113928K09	Cap Cer Chip 10.0uF 10% 6.3V X5R 1206
C211	2113928K09	Cap Cer Chip 10.0uF 10% 6.3V X5R 1206
C212	2113928C04	Cap Cer Chip 4.7uF 10% 6.3V X5R 0805
C213	Not Placed	GCAM Dummy Part Number

Circuit Ref	Motorola Part No.	Description
C214	2113928C04	Cap Cer Chip 4.7uF 10% 6.3V X5R 0805
C215	2113928C04	Cap Cer Chip 4.7uF 10% 6.3V X5R 0805
C216	2113928K09	Cap Cer Chip 10.0uF 10% 6.3V X5R 1206
C217	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C218	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C219	2113743A27	Cap Cer Chip .470uF 10% 16V X7R 0805
C220	2113743A27	Cap Cer Chip .470uF 10% 16V X7R 0805
C221	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C222	2113743T19	Cap Cer Chip 10.0uF 10% 16V X5R 3225
C223	2113928K09	Cap Cer Chip 10.0uF 10% 6.3V X5R 1206
C224	2113928K09	Cap Cer Chip 10.0uF 10% 6.3V X5R 1206
C225	2311049A97	Cap Tant Chip 33uF 20% 16V C
C226	2113928K09	Cap Cer Chip 10.0uF 10% 6.3V X5R 1206
C227	2113928C04	Cap Cer Chip 4.7uF 10% 6.3V X5R 0805
C228	2113743M24	Cap Cer Chip 0.1uF +80/-20% 16V Y5V 0402
C229	2113928A01	Cap Cer Chip 1.0uF +80/-20% 10V Y5V 0603
C230	2113928A01	Cap Cer Chip 1.0uF +80/-20% 10V Y5V 0603
C231	2113928A01	Cap Cer Chip 1.0uF +80/-20% 10V Y5V 0603
C232	2113928A01	Cap Cer Chip 1.0uF +80/-20% 10V Y5V 0603
C233	2113928A01	Cap Cer Chip 1.0uF +80/-20% 10V Y5V 0603
C234	2113743M24	Cap Cer Chip 0.1uF +80/-20% 16V Y5V 0402
C235	2113928A01	Cap Cer Chip 1.0uF +80/-20% 10V Y5V 0603
C236	2113743L17	Cap Cer Chip 1000pF 10% 16V X7R 0402
C237	2113743N30	Cap Cer Chip 15.0pF 5% 16V COG 0402
C238	2113743N30	Cap Cer Chip 15.0pF 5% 16V COG 0402
C239	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402

Circuit Ref	Motorola Part No.	Description
C240	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C241	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C242	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C243	2113928K09	Cap Cer Chip 10.0uF 10% 6.3V X5R 1206
C244	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C245	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C246	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C247	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C248	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C249	2113928C04	Cap Cer Chip 4.7uF 10% 6.3V X5R 0805
C250	2113743M24	Cap Cer Chip 0.1uF +80/-20% 16V Y5V 0402
C251	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C252	2113928K09	Cap Cer Chip 10.0uF 10% 6.3V X5R 1206
C253	2113743L41	Cap Cer Chip 10000pF 10% 16V X7R 0402
C254	2113928A01	Cap Cer Chip 1.0uF +80/-20% 10V Y5V 0603
C255	2113928K09	Cap Cer Chip 10.0uF 10% 6.3V X5R 1206
C256	Not Placed	GCAM Dummy Part Number
C257	Not Placed	GCAM Dummy Part Number
C258	2113928C04	Cap Cer Chip 4.7uF 10% 6.3V X5R 0805
C259	2113928C04	Cap Cer Chip 4.7uF 10% 6.3V X5R 0805
C260	2113928C04	Cap Cer Chip 4.7uF 10% 6.3V X5R 0805
C261	2113928C04	Cap Cer Chip 4.7uF 10% 6.3V X5R 0805
C262	2113743L03	Cap Cer Chip 270pF 10% 16V X7R 0402
C263	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C264	2113743L03	Cap Cer Chip 270pF 10% 16V X7R 0402
C265	Not Placed	GCAM Dummy Part Number
C266	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402

Circuit Ref	Motorola Part No.	Description
C267	2113743L17	Cap Cer Chip 1000pF 10% 16V X7R 0402
C268	2113743T19	Cap Cer Chip 10.0uF 10% 16V X5R 3225
C269	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C270	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C271	2113928D08	Cap Cer Chip 10.0uF 10% 10V Y5V 1206
C272	Not Placed	GCAM Dummy Part Number
C273	2113743T19	Cap Cer Chip 10.0uF 10% 16V X5R 3225
C274	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C275	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C276	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C277	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C278	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C279	2113743N41	Cap Cer Chip 43.0pF 5% 16V COG 0402
C280	2113743T19	Cap Cer Chip 10.0uF 10% 16V X5R 3225
C281	2113743T19	Cap Cer Chip 10.0uF 10% 16V X5R 3225
C282	2113928K09	Cap Cer Chip 10.0uF 10% 6.3V X5R 1206
C283	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C284	2113928K09	Cap Cer Chip 10.0uF 10% 6.3V X5R 1206
C285	2113928A01	Cap Cer Chip 1.0uF +80/-20% 10V Y5V 0603
C286	2113743L03	Cap Cer Chip 270pF 10% 16V X7R 0402
C287	2113743L17	Cap Cer Chip 1000pF 10% 16V X7R 0402
C288	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C289	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C290	2113743L03	Cap Cer Chip 270pF 10% 16V X7R 0402
C291	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C292	2113743L03	Cap Cer Chip 270pF 10% 16V X7R 0402

Circuit Ref	Motorola Part No.	Description
C293	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C294	2113743L03	Cap Cer Chip 270pF 10% 16V X7R 0402
C295	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C296	2113743M24	Cap Cer Chip 0.1uF +80/-20% 16V Y5V 0402
C297	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C298	2113741F47	Cap Cer Chip 8200pF 5% 50V X7R 0603
C299	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C401	Not Placed	GCAM Dummy Part Number
C402	2113743M24	Cap Cer Chip 0.1uF +80/-20% 16V Y5V 0402
D202	4813833A19	Diode Schottky 1A 20V PWR-MITE
D203	4813833A19	Diode Schottky 1A 20V PWR-MITE
D204	4813825A19	Diode Schottky Barrier Series
E200	2480675U01	0805 CHIP-3AMP
E201	2409134J04	Ind Chip Fer Fltr 600 0603
E202	2409134J04	Ind Chip Fer Fltr 600 0603
E203	2409134J04	Ind Chip Fer Fltr 600 0603
E204	2409134J04	Ind Chip Fer Fltr 600 0603
E205	2480675U01	0805 CHIP-3AmP
E206	2480675U01	0805 CHIP-3Amp
E207	2480675U01	0805 CHIP-3Amp
E208	2480675U01	0805 CHIP-3Amp
E209	2480675U01	0805 CHIP-3Amp
E210	2409134J04	Ind Chip Fer Fltr 600 0603
E211	2409134J04	Ind Chip Fer Fltr 600 0603
E212	2480675U01	0805 Chip-3Amp
E213	2480675U01	0805 Chip-3Amp
E214	2480675U01	0805 Chip-3Amp
E215	2409134J04	Ind Chip Fer Fltr 600 0603
F200	6586221J04	Fuse 2.5A 16V SMD
L200	2408603Y01	Idctr 4.7uH
L201	2486085A02	Idctr 15uH
L202	2404927K02	Idctr 47uH +/-20%
Q201	5102463J80	FDC6330L Integrated Load Switch
Q202	4805128M27	Sot Trans BSR33
Q204	4802245J54	UMG5N Digital Transistor
R202	0662057N15	Res Chip 47k 5% 0.063W 0402
R203	0662057N15	Res Chip 47k 5% 0.063W 0402
R204	0662057N15	Res Chip 47k 5% 0.063W 0402
R205	0662057N17	Res Chip 56k 5% 0.063W 0402
R206	0662057M96	Res Chip 8200 5% 0.063W 0402

Circuit Ref	Motorola Part No.	Description
R207	0662057M96	Res Chip 8200 5% 0.063W 0402
R208	0662057B20	Res Chip 820k 5% 0.1W 0603
R209	0662057M82	Res Chip 2200 5% 0.063W 0402
R210	0662057N11	Res Chip 33k 5% 0.063W 0402
R211	0662057M93	Res Chip 6200 5% 0.063W 0402
R212	0662057N11	Res Chip 33k 5% 0.063W 0402
R213	0662057M82	Res Chip 2200 5% 0.063W 0402
R214	0662057M82	Res Chip 2200 5% 0.063W 0402
R215	0662057N30	Res Chip 200k 5% 0.063W 0402
R217	0662057N13	Res Chip 39k 5% 0.063W 0402
R218	Not Placed	GCAM Dummy Part Number
R220	0662057B05	Res Chip 200k 5% 0.1W 0603
R221	0662057N13	Res Chip 39k 5% 0.063W 0402
R225	0662057N13	Res Chip 39k 5% 0.063W 0402
R229	0662057N13	Res Chip 39k 5% 0.063W 0402
R230	0662057M96	Res Chip 8200 5% 0.063W 0402
R232	0662057M50	Res Chip 100 5% 0.063W 0402
R235	Not Placed	GCAM Dummy Part Number
R240	0662057N11	Res Chip 33k 5% 0.063W 0402
R241	0662057N05	Res Chip 18k 5% 0.063W 0402
R242	0662057M94	Res Chip 6800 5% 0.063W 0402
R243	0662057M74	Res Chip 1000 5% 0.063W 0402
R244	0662057M74	Res Chip 1000 5% 0.063W 0402
R245	0662057M90	Res Chip 4700 5% 0.063W 0402
R252	0662057N06	Res Chip 20k 5% 0.063W 0402
R254	0662057V30	Res Chip 130k 5% 0.063W 0402
R255	0662057M26	Res Chip 10 5% 0.063W 0402
R256	0662057N06	Res Chip 20k 5% 0.063W 0402
R271	0662057M78	Res Chip 1500 5% 0.063W 0402
R272	0662057N13	Res Chip 39k 5% 0.063W 0402
R274	0662057N16	Res Chip 51k 5% 0.063W 0402
R275	0662057N14	Res Chip 43k 5% 0.063W 0402
R277	Not Placed	GCAM Dummy Part Number
R278	0662057N06	Res Chip 20k 5% 0.063W 0402
R279	0662057V30	Res Chip 130k 5% 0.063W 0402
R280	0662057M98	Res Chip 10k 5% 0.063W 0402
R281	0662057M98	Res Chip 10k 5% 0.063W 0402
R284	0662057N13	Res Chip 39k 5% 0.063W 0402
R285	0662057N13	Res Chip 39k 5% 0.063W 0402
R287	0662057N23	Res Chip 100k 5% 0.063W 0402
R296	0662057A18	Res Chip 51 5% 0.1W 0603
RT200	0686931J01	Thermistor 47k
SH200	2686114Z01	Primary Shield, GCAP3
SH201	2686120Z01	Primary Shield, Switching Regulator
U200	5109879E83	IC BICMOS GCAP3 V2.2 179BGA
U201	5102463J75	MAX1685 Step Down Regulator
U202	5102463J44	Audio Amplifier TDA8547TS
U205	5102463J82	ADP3331 Linear Voltage Regulator

Circuit Ref	Motorola Part No.	Description
VR201	4813830C26	Diode 13V 'H3' MMSZ5243BT1
Y200	4809995L05	Xtal Quartz 32.768kHZ CC4V-T1
C300	2113743L41	Cap Cer Chip 10000pF 10% 16V X7R 0402
C301	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C302	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C303	2113743L41	Cap Cer Chip 10000pF 10% 16V X7R 0402
C304	2113741F45	Cap Cer Chip 6800pF 5% 50V X7R 0603
C305	2113741F49	Cap Cer Chip 10000pF 5% 50V X7R 0603
C306	2113928K09	Cap Cer Chip 10.0uF 10% 6.3V X5R 1206
C307	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C308	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C309	2113928P04	Cap Cer Chip 1.0uF 20% 6.3V X5R 0603
C310	2113743N54	Cap Cer Chip 150pF 5% 16V COG 0402
C311	2113928P04	Cap Cer Chip 1.0uF 20% 6.3V X5R 0603
C312	2113928K09	Cap Cer Chip 10.0uF 10% 6.3V X5R 1206
C313	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C314	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C315	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C316	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C317	2113743L41	Cap Cer Chip 10000pF 10% 16V X7R 0402
C318	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C319	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C320	2113743L41	Cap Cer Chip 10000pF 10% 16V X7R 0402
C321	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C322	2113743L41	Cap Cer Chip 10000pF 10% 16V X7R 0402
C323	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402

Circuit Ref	Motorola Part No.	Description
C324	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C325	2113743L41	Cap Cer Chip 10000pF 10% 16V X7R 0402
C326	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C327	2113743L41	Cap Cer Chip 10000pF 10% 16V X7R 0402
C328	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
C329	2113928K09	Cap Cer Chip 10.0uF 10% 6.3V X5R 1206
C330	2113743N38	Cap Cer Chip 33.0pF 5% 16V COG 0402
C331	Not Placed	GCAM Dummy Part Number
C340	2113743L03	Cap Cer Chip 270pF 10% 16V X7R 0402
C341	2113928N01	Cap Cer Chip 0.1uF 10% 6.3V X5R 0402
E302	2480067M02	CHK RF Chip Bead Inductor
L301	2409377M36	IND CHIP WW 220nH 5% 0603
R307	0662057N13	Res Chip 39k 5% 0.063W 0402
R308	0662057N13	Res Chip 39k 5% 0.063W 0402
R309	0662057M01	Res Chip 0 5% 0.063W 0402
R310	Not Placed	GCAM Dummy Part Number
R312	0662057A18	Res Chip 51 5% 0.1W 0603
R313	Not Placed	GCAM Dummy Part Number
R314	0662057N07	Res Chip 22k 5% 0.063W 0402
R315	0662057M94	Res Chip 6800 5% 0.063W 0402
R316	Not Placed	GCAM Dummy Part Number
R318	0662057M01	Res Chip 0 5% 0.063W 0402
R319	0662057M01	Res Chip 0 5% 0.063W 0402
R324	0662057N13	Res Chip 39k 5% 0.063W 0402
SH300	2686110Z01	Primary Shield, Controller
SH301	2686119Z01	Primary Shield, Memories
U301	5185368C99	IC 17X17 256 MAPBGA
U302	5109509A43	IC 512k x 16, 1MB SRAM
U303	5102476J01	Intel 64MBIT Flash GE28F640C3
U304	5109522E22	IC Sngl And Gate TC7S08FU
U305	5102463J77	MC74HC1G04 NOT GATE
U307	5109522E22	IC Sngl And Gate TC7S08FU
U308	9185759B01	Fltr RC Network

Troubleshooting (400 MHz)

General

Troubleshooting faults in the radio require proper understanding of the different circuitry contained in the radio. Since the radio contains a highly integrated system, the software and hardware functions can not be separated easily. Thus, it is also necessary to understand the functioning of different ICs and the role of the software in the operation of the radio.

This service manual includes schematic diagrams, circuit board layouts, block diagrams, and troubleshooting procedures, which help a technician to troubleshoot a malfunctioning circuit and detect a defective component.

NOTE **The CPS has no capability to tune the radio. Tuning the radio can only be performed at the factory or at the appropriate Motorola Repair Centre. Components replacement can affect the radio tuning and must only be performed by the appropriate Motorola Repair Centre.**

The radio is tuned and tested at the factory. The results of the tuning procedures are stored in a special EEPROM. This information includes tuning and other system parameters. The area of the memory in the radio where the tuning information stored is called the “codeplug”. A radio codeplug can be read using the CPS programme.

Test Procedures

This section explains the procedures required to troubleshoot a MTP700 radio.

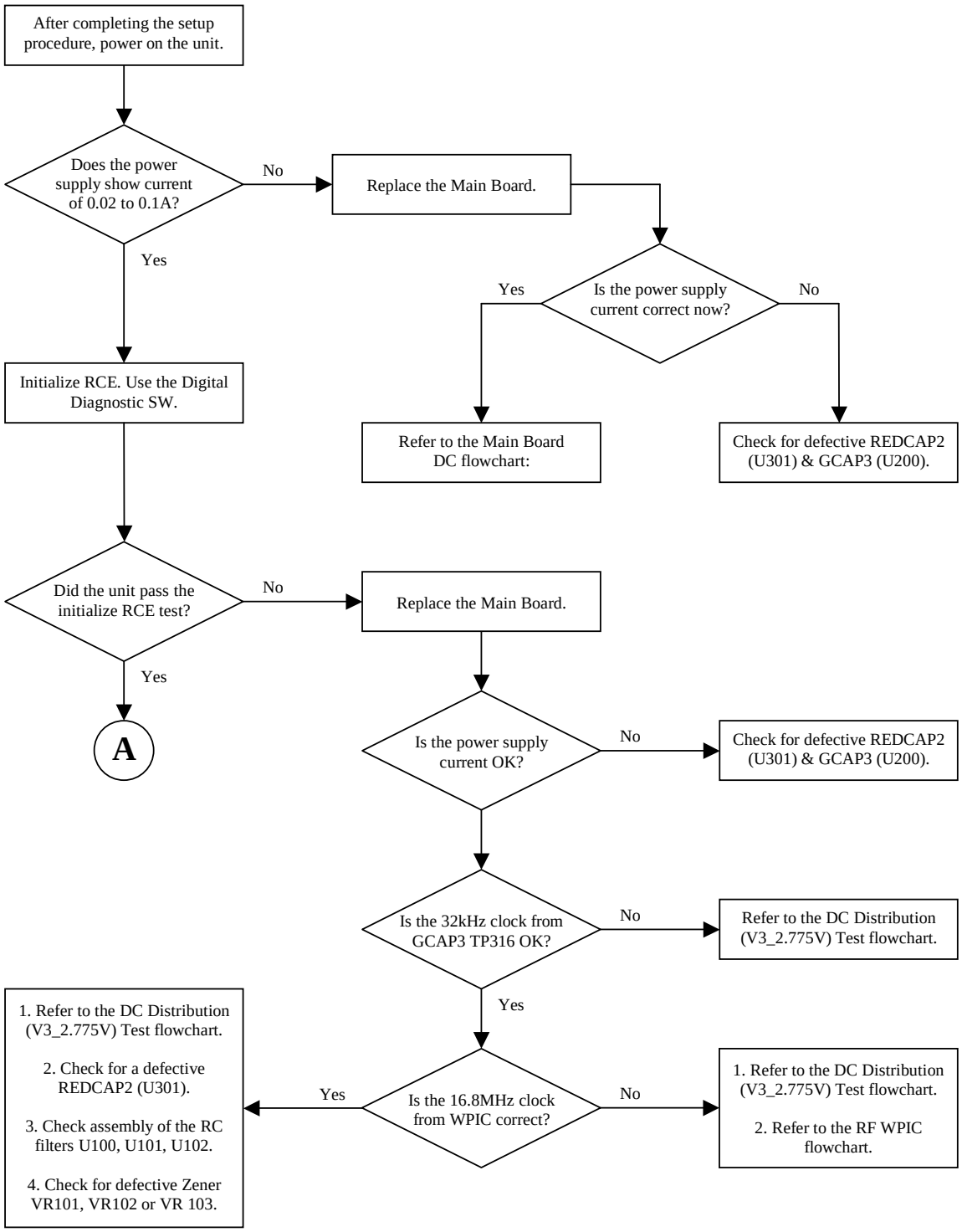
The digital tests should be performed using the GoNoGo PATS test and TETRACom SW. To use the TETRACom you must go to test mode by using the command <Test Enter>.

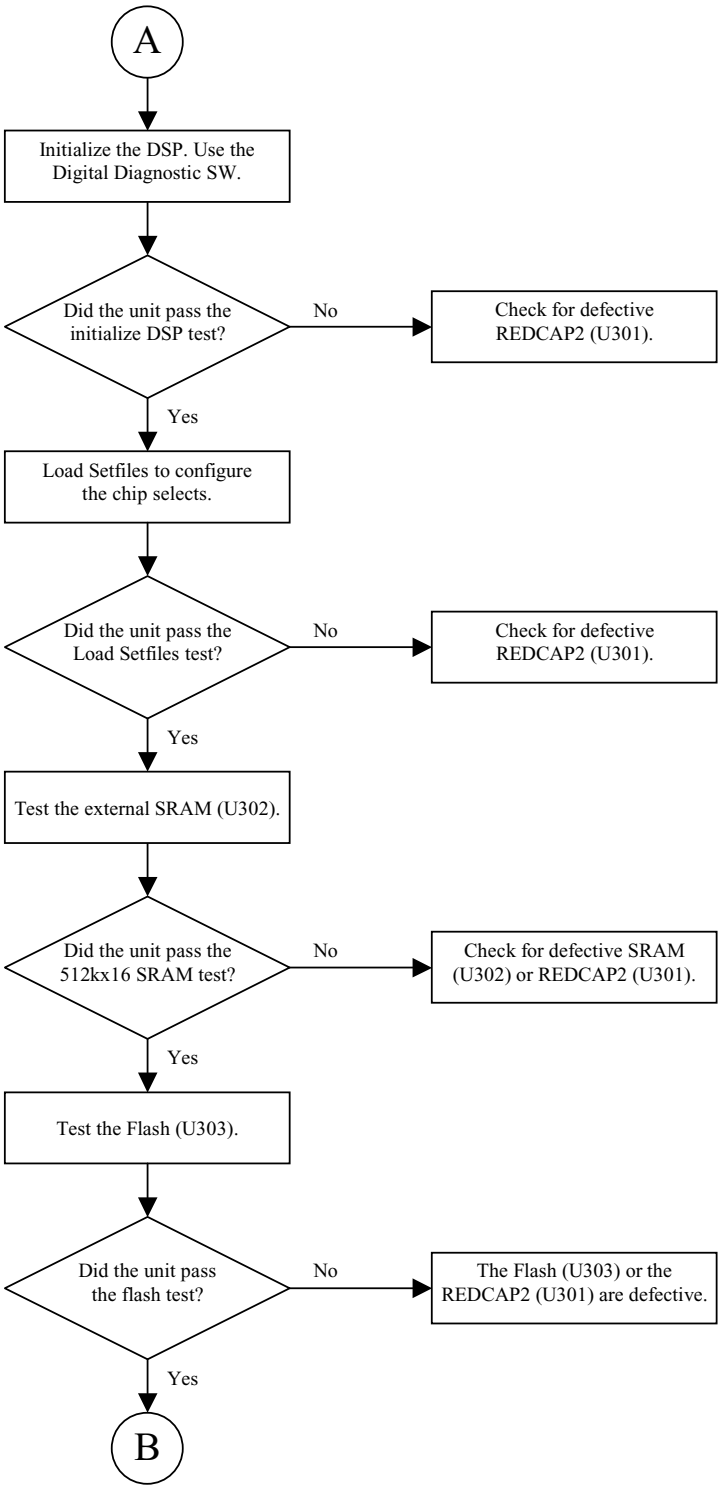
Troubleshooting Flowcharts

Use the following flowcharts to troubleshoot the radio. These flowcharts contain procedures using TETRACom SW application, GoNoGo PATS test and factory test modes for troubleshooting radios having digital, receiver, transmitter, or frequency generation test failures.

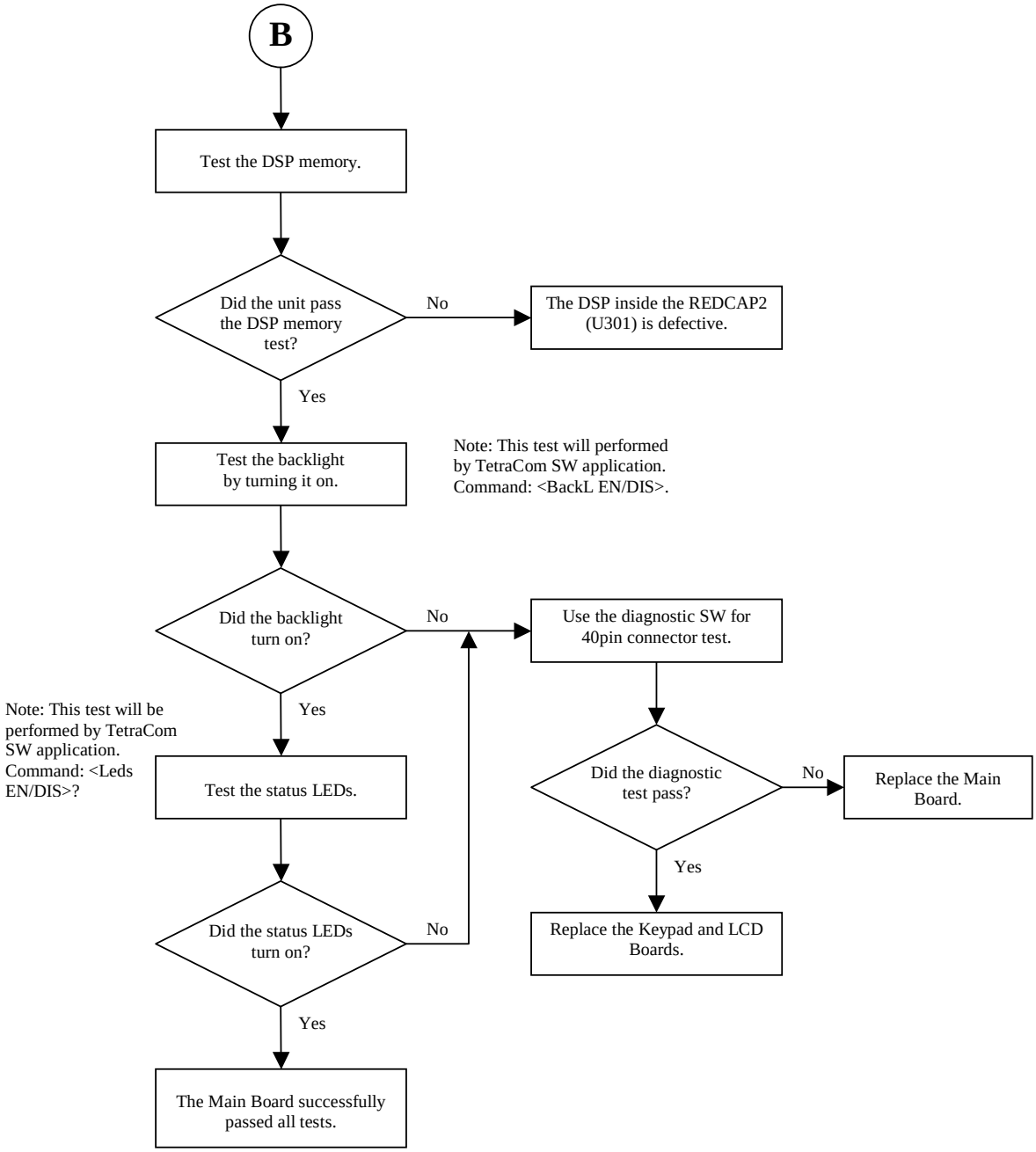
Digital Analysis Test

Use this test for troubleshooting the main board


After completing the setup procedure, power on the unit.
Does the power supply show current of 0.02 to 0.1A?
No
Replace the Main Board.
Yes
Is the power supply current correct now?
Yes
No
Initialize RCE. Use the Digital Diagnostic SW.
Refer to the Main Board DC flowchart:
Check for defective REDCAP2 (U301) & GCAP3 (U200).
Did the unit pass the initialize RCE test?
No
Replace the Main Board.
Yes
A
Is the power supply current OK?
No
Check for defective REDCAP2 (U301) & GCAP3 (U200).
Is the 32kHz clock from GCAP3 TP316 OK?
No
Refer to the DC Distribution (V3_2.775V) Test flowchart.
Yes
1. Refer to the DC Distribution (V3_2.775V) Test flowchart.
2. Check for a defective REDCAP2 (U301).
3. Check assembly of the RC filters U100, U101, U102.
4. Check for defective Zener VR101, VR102 or VR 103.
Yes
Is the 16.8MHz clock from WPIC correct?
No
1. Refer to the DC Distribution (V3_2.775V) Test flowchart.
2. Refer to the RF WPIC flowchart.


A
Initialize the DSP. Use the Digital Diagnostic SW.
Did the unit pass the initialize DSP test?
No
Check for defective REDCAP2 (U301).
Yes
Load Setfiles to configure the chip selects.
Did the unit pass the Load Setfiles test?
No
Check for defective REDCAP2 (U301).
Yes
Test the external SRAM (U302).
Did the unit pass the 512kx16 SRAM test?
No
Check for defective SRAM (U302) or REDCAP2 (U301).
Yes
Test the Flash (U303).
Did the unit pass the flash test?
No
The Flash (U303) or the REDCAP2 (U301) are defective.
Yes
B

Digital Analysis Test (Cont.)


B
Test the DSP memory.
Did the unit pass the DSP memory test?
No
The DSP inside the REDCAP2 (U301) is defective.
Yes
Test the backlight by turning it on.
Note: This test will performed by TetraCom SW application. Command: <BackL EN/DIS>.
Did the backlight turn on?
No
Use the diagnostic SW for 40pin connector test.
Yes
Note: This test will be performed by TetraCom SW application. Command: <Leds EN/DIS>?
Test the status LEDs.
Did the diagnostic test pass?
No
Replace the Main Board.
Yes
Did the status LEDs turn on?
No
Replace the Keypad and LCD Boards.
Yes
The Main Board successfully passed all tests.

DC Distribution (V3_2.775V) Test

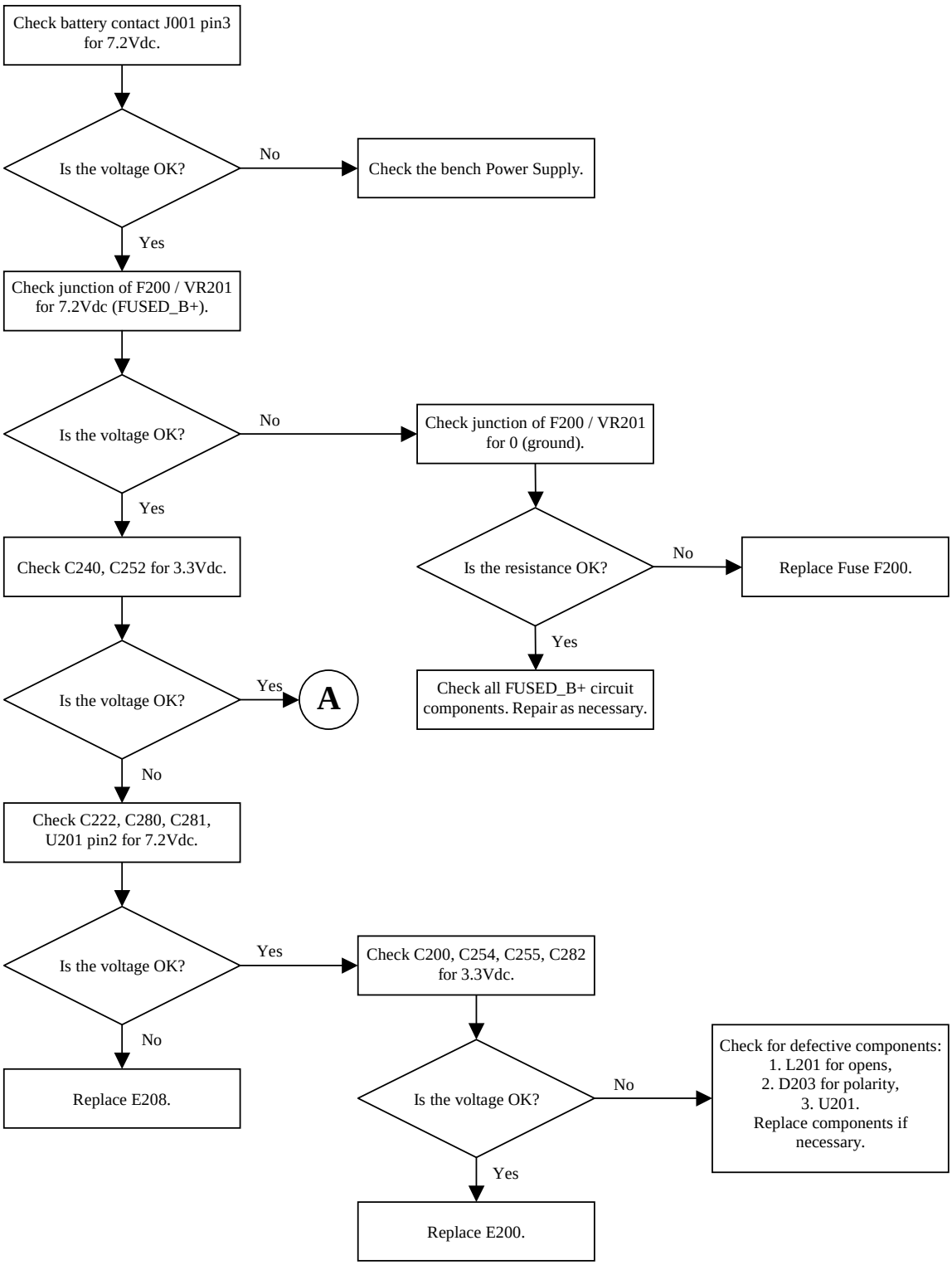
Use this test on a unit with the following symptoms: no power, no V3_2.775V, V1_3V, V2_2.775V, VREF1_2.775V, VREF2_2.775V.

Note: The following are the DC power distribution voltages with their correct values and appropriate location to check the voltages:

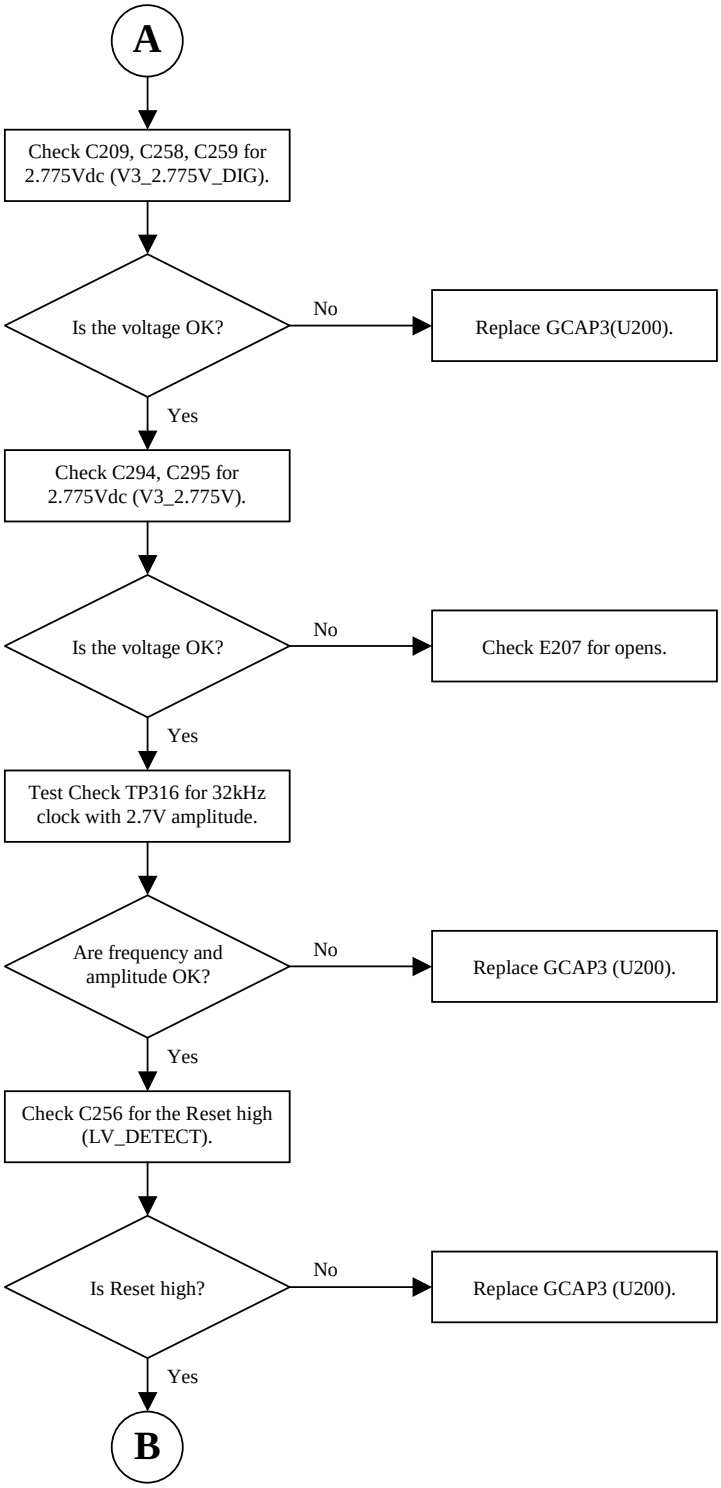
- FUSED B+ (7.2Vdc) @ F200, C268, VR201, @ C222, C228, C250, C280, C281.
- FILT_3.3V (3.3Vdc) @ C282, C255, C260, C284, @ C240, C241, @ C201, C242.
- V1_3V (3Vdc) @ C211, @ C264, C266..
- V2_2.775V (2.775Vdc) @ C210, C213, C257.
- V3_2.775V_DIG (2.775Vdc) @ C209, C258, C259.
- V3_2.775V (2.775Vdc) @ C294, C295
- VREF1_2.775V (2.775Vdc) @ C285.
- VREF2_2.775V_DIG (2.775Vdc) @ C212, C260, C261.
- VREF2_2.775V (2.775Vdc) @ C262, C263.
- V4_2.775V_GCAP3 (2.775Vdc) @ C225, C244, C247.
- V4_2.775V (2.775Vdc) @ C90, C291.
- V4_2.775V_LNODCT (2.775Vdc) @ C340, C341.
- 5V_RF (5Vdc) @ C292, C293, @ C251, C223.
- PWM1_1.8V (1.8Vdc) @ C224, C226, C243, C248.
- 5.5V_RF (5.5Vdc) @ C299, C220.

DC Distribution (V3_2.775V) Test

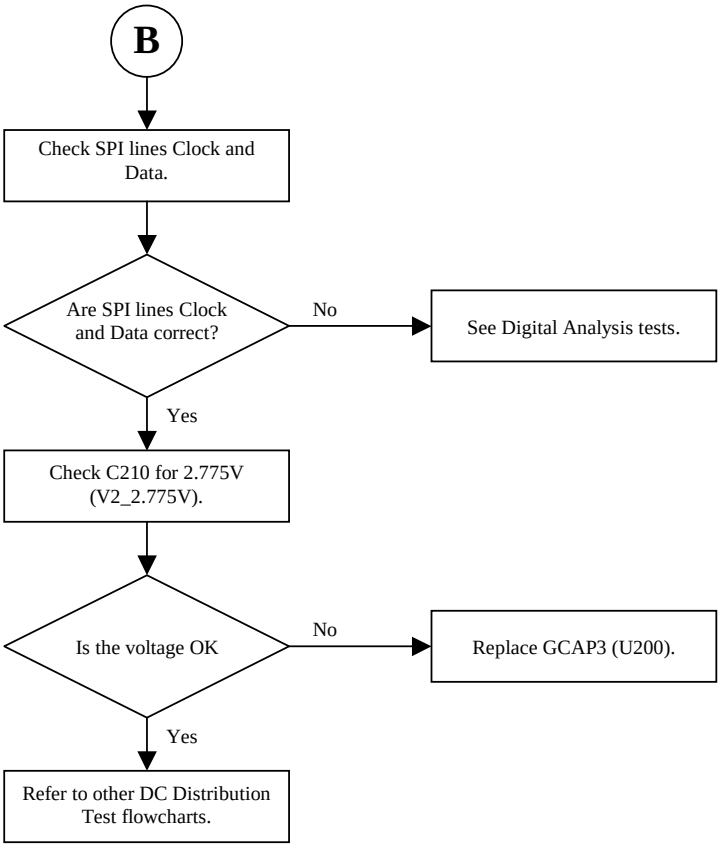
Use this test on a unit with the following symptoms: no V3_2.775V.



DC Distribution (V3_2.775V) Test (Cont.)

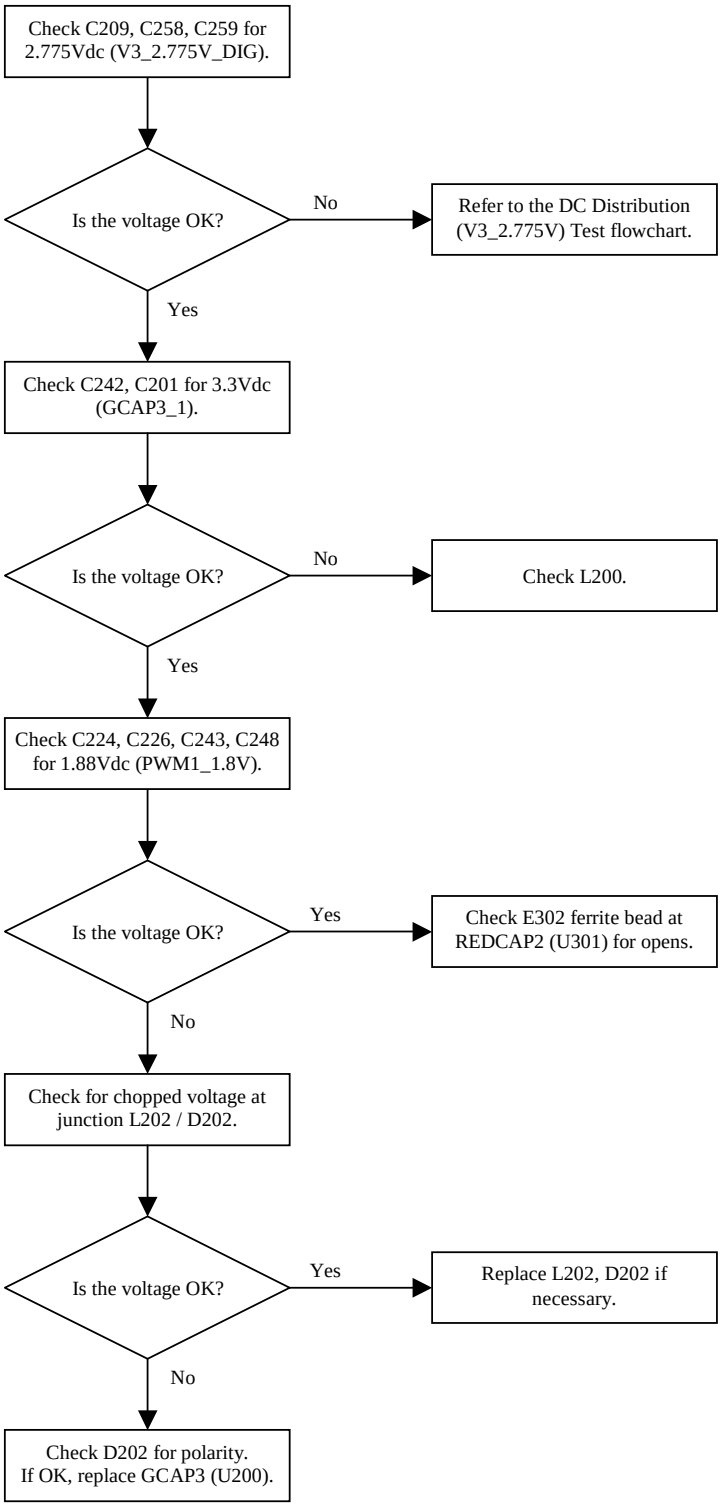


DC Distribution (V3_2.775V) Test (Cont.)



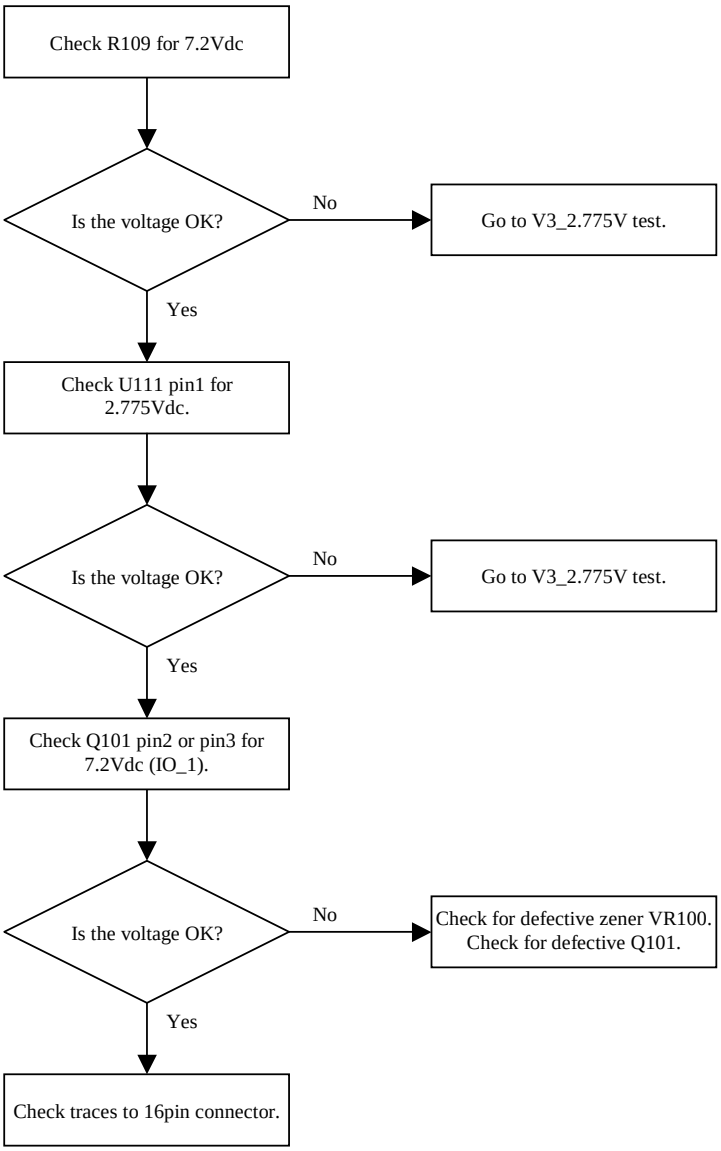
DC Distribution (V3_2.775V/PWM1_1.8V) Test

Use this test on a unit with the following symptoms: no V3_2.775V, no PWM1_1.8V.


Check C209, C258, C259 for 2.775Vdc (V3_2.775V_DIG).
Is the voltage OK?
No
Refer to the DC Distribution (V3_2.775V) Test flowchart.
Yes
Check C242, C201 for 3.3Vdc (GCAP3_1).
Is the voltage OK?
No
Check L200.
Yes
Check C224, C226, C243, C248 for 1.88Vdc (PWM1_1.8V).
Is the voltage OK?
Yes
Check E302 ferrite bead at REDCAP2 (U301) for opens.
No
Check for chopped voltage at junction L202 / D202.
Is the voltage OK?
Yes
Replace L202, D202 if necessary.
No
Check D202 for polarity. If OK, replace GCAP3 (U200).

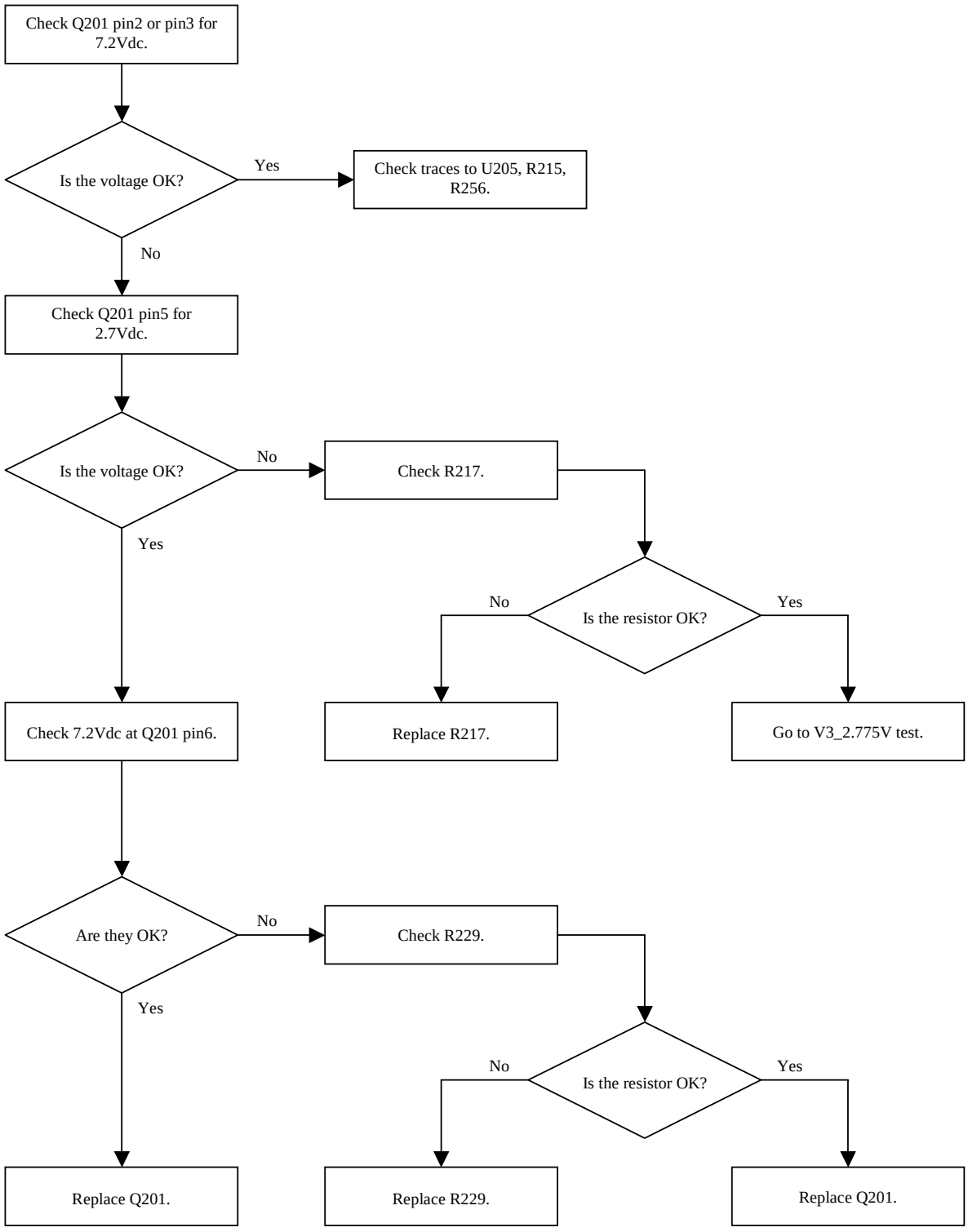
DC Distribution (BOT_SWB+) Test

Use this test on a unit with the following symptoms: no BOT_SWB+ .



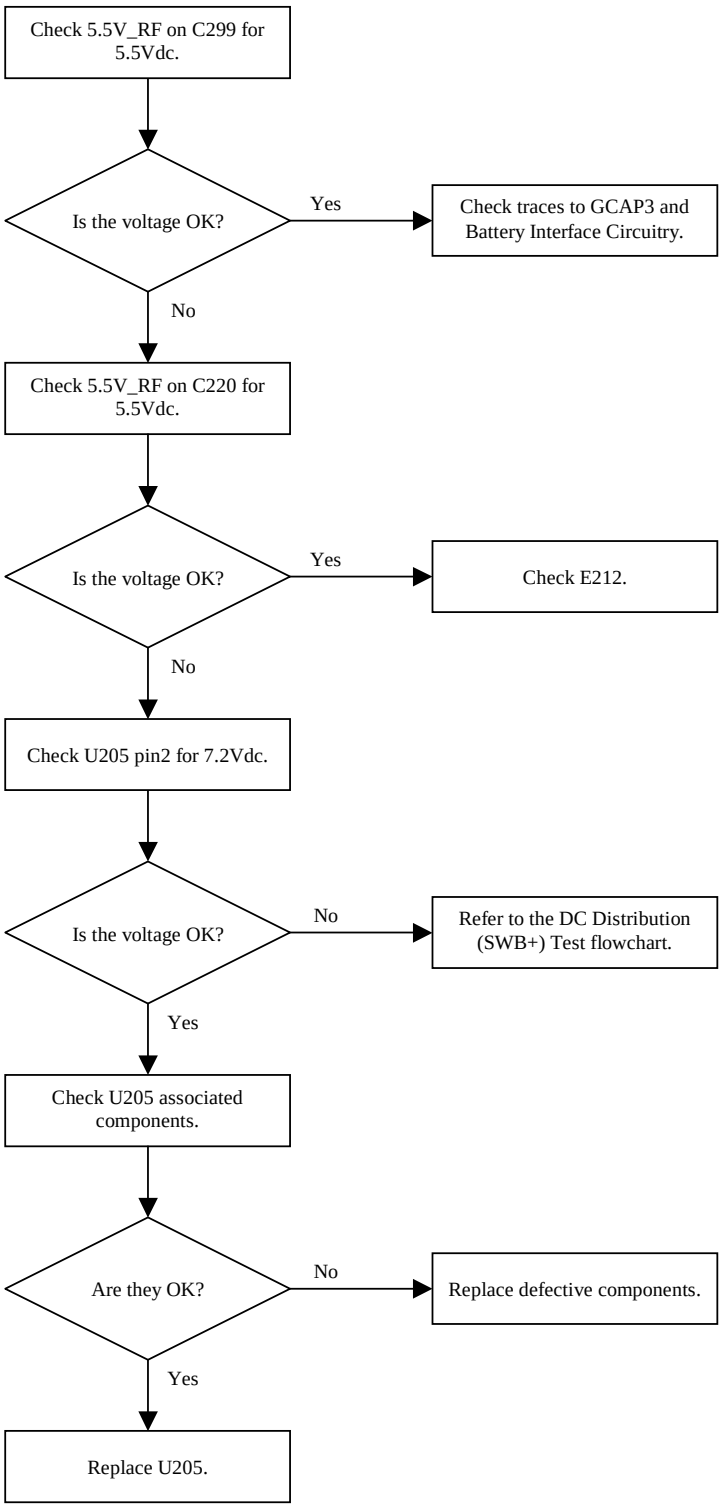
DC Distribution (SWB+ 7.2V) Test

Use this test on a unit with the following symptoms: no 7.2Vdc SWB+.



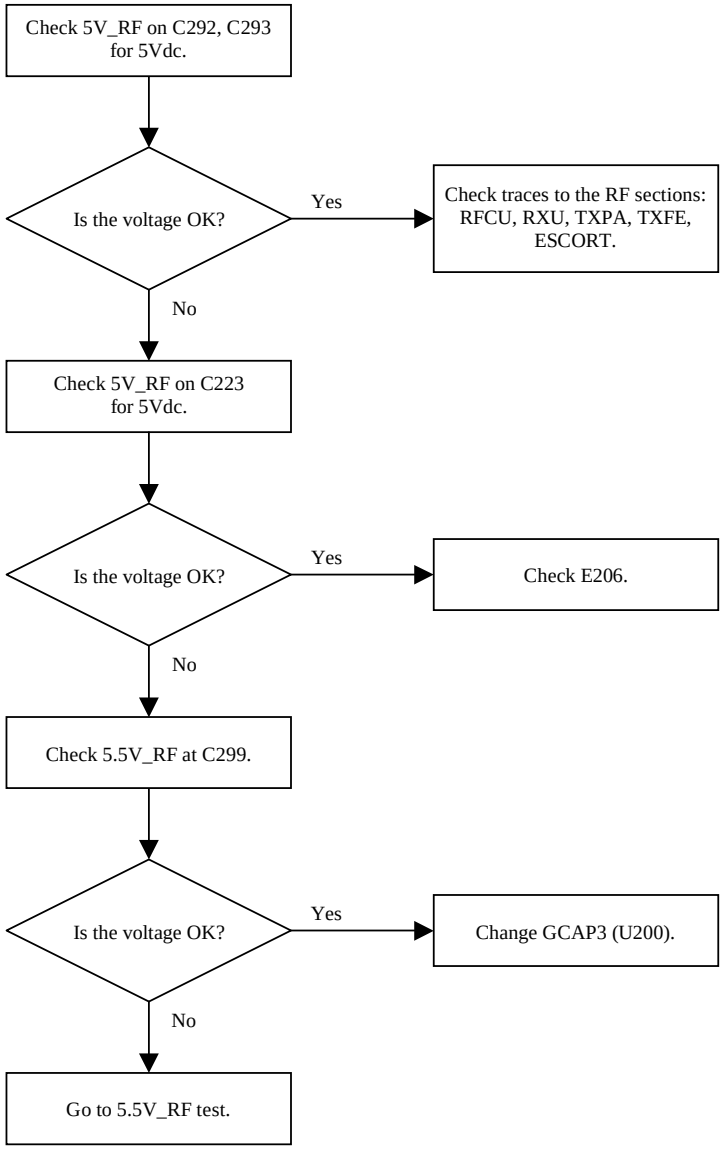
DC Distribution (5.5V_RF) Test

Use this test on a unit with the following symptoms: no 5.5V_RF.



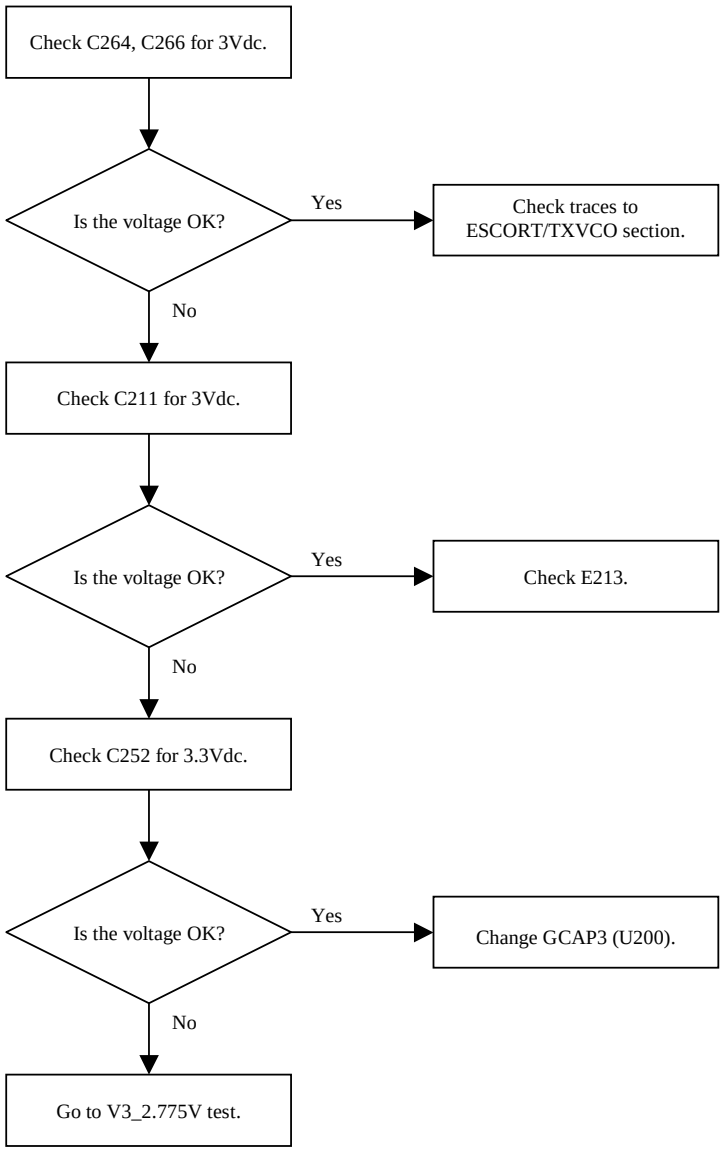
DC Distribution (5V_RF) Test

Use this test on a unit with the following symptoms: no 5V_RF.



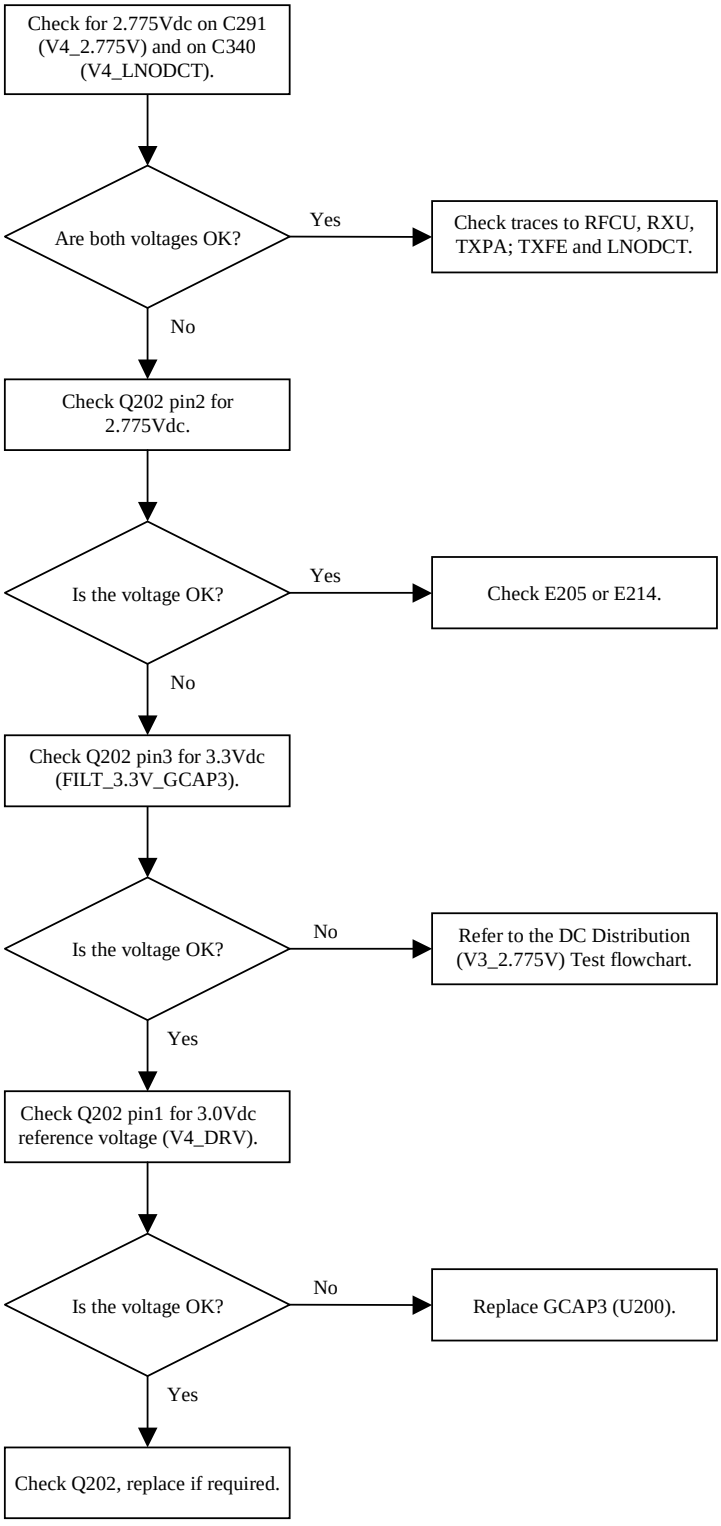
DC Distribution (V1_3V) Test

Use this test on a unit with the following symptoms: no V1_3V.



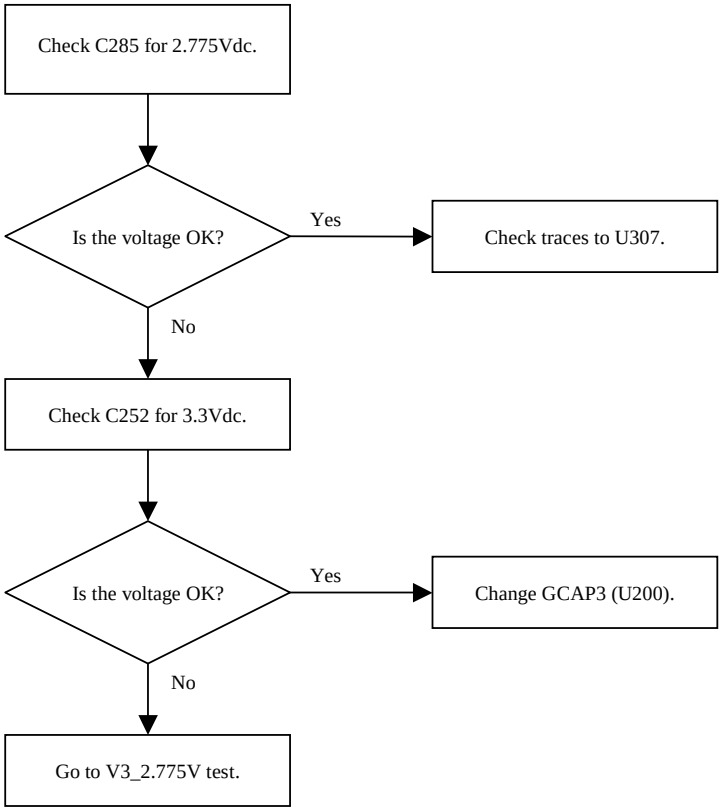
DC Distribution (V4_2.775V) Test

Use this test on a unit with the following symptoms: no V4_2.775V.



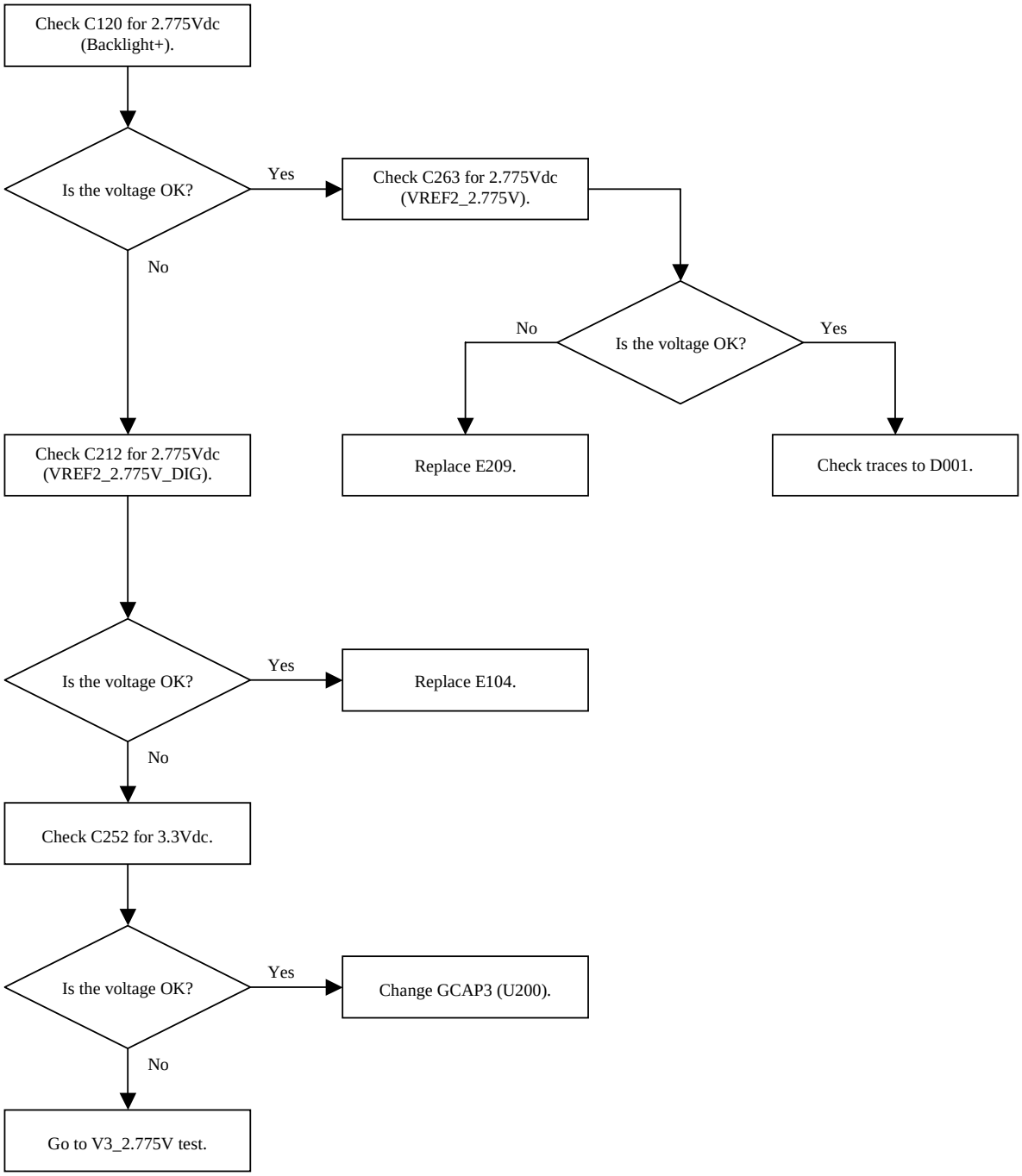
DC Distribution (VREF1_2.775V) Test

Use this test on a unit with the following symptoms: no VREF1_2.775V.



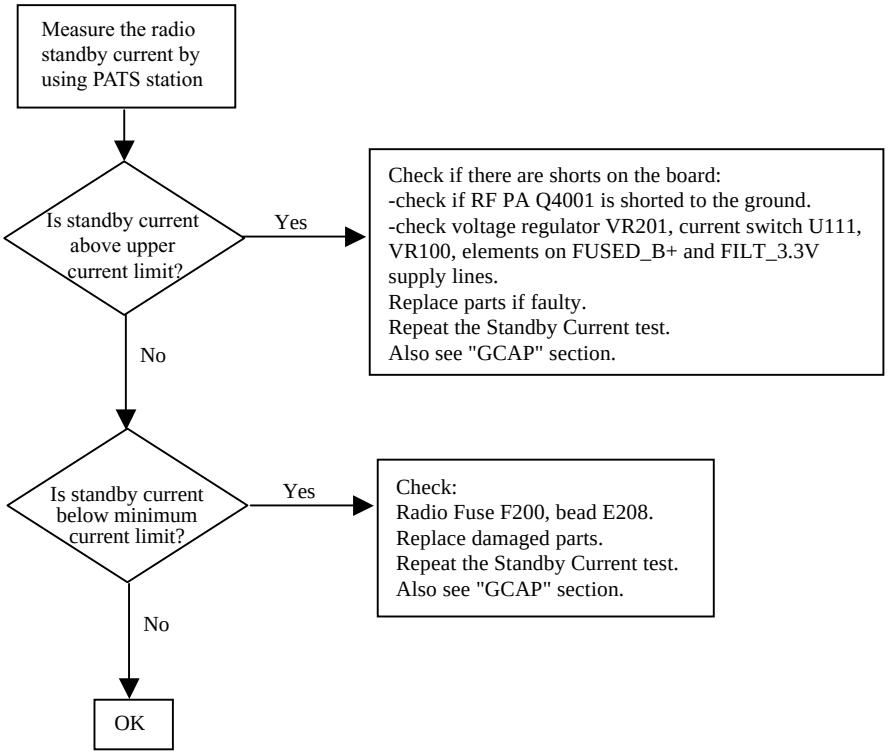
DC Distribution (VREF2_2.775V) Test

Use this test on a unit with the following symptoms: no VREF2_2.775V

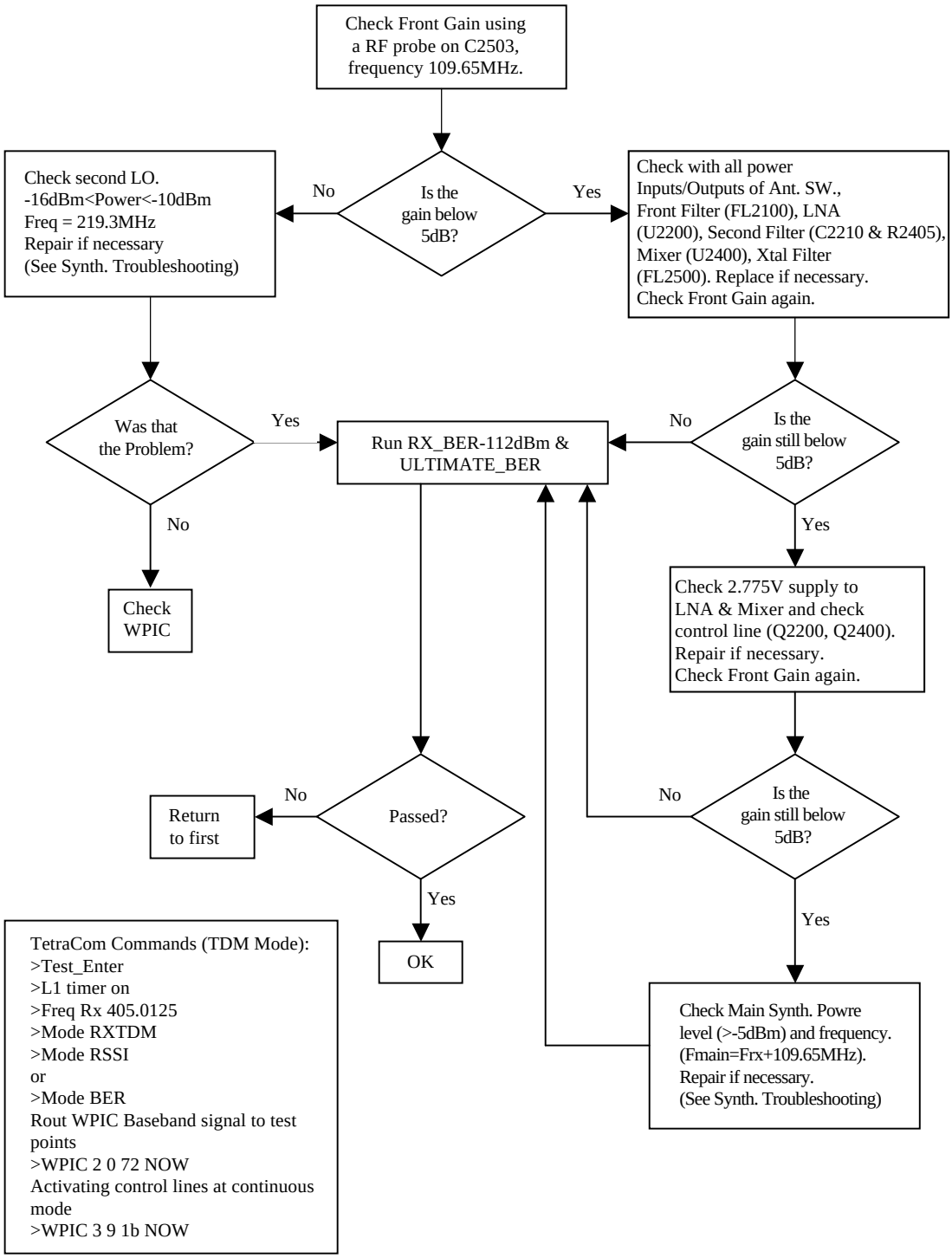


Standby Current Troubleshooting

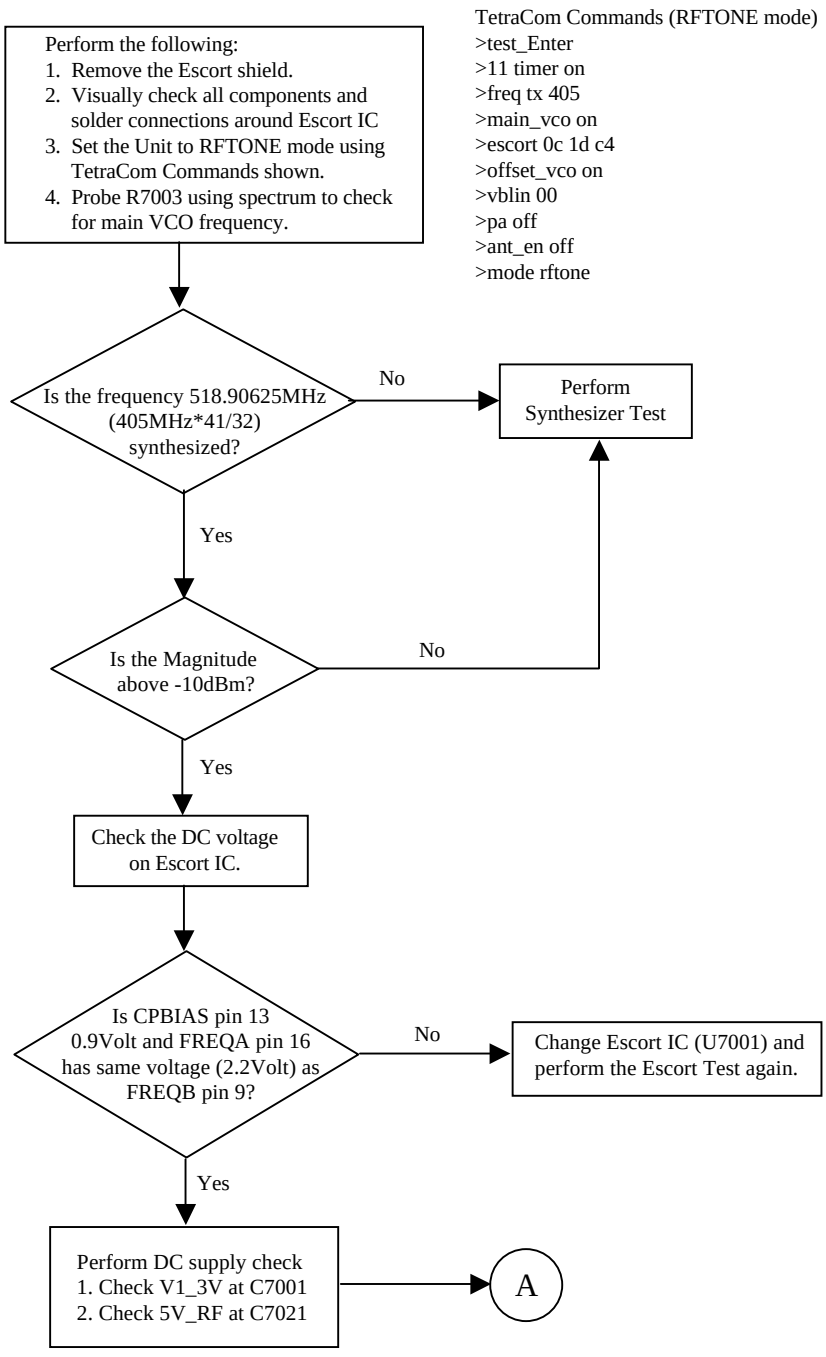
This test should be carried out only after the successful completion of the previous tests.


Measure the radio standby current by using PATS station
Is standby current above upper current limit?
Yes
Check if there are shorts on the board:
-check if RF PA Q4001 is shorted to the ground.
-check voltage regulator VR201, current switch U111, VR100, elements on FUSED_B+ and FILT_3.3V supply lines.
Replace parts if faulty.
Repeat the Standby Current test.
Also see "GCAP" section.
No
Is standby current below minimum current limit?
Yes
Check:
Radio Fuse F200, bead E208.
Replace damaged parts.
Repeat the Standby Current test.
Also see "GCAP" section.
No
OK

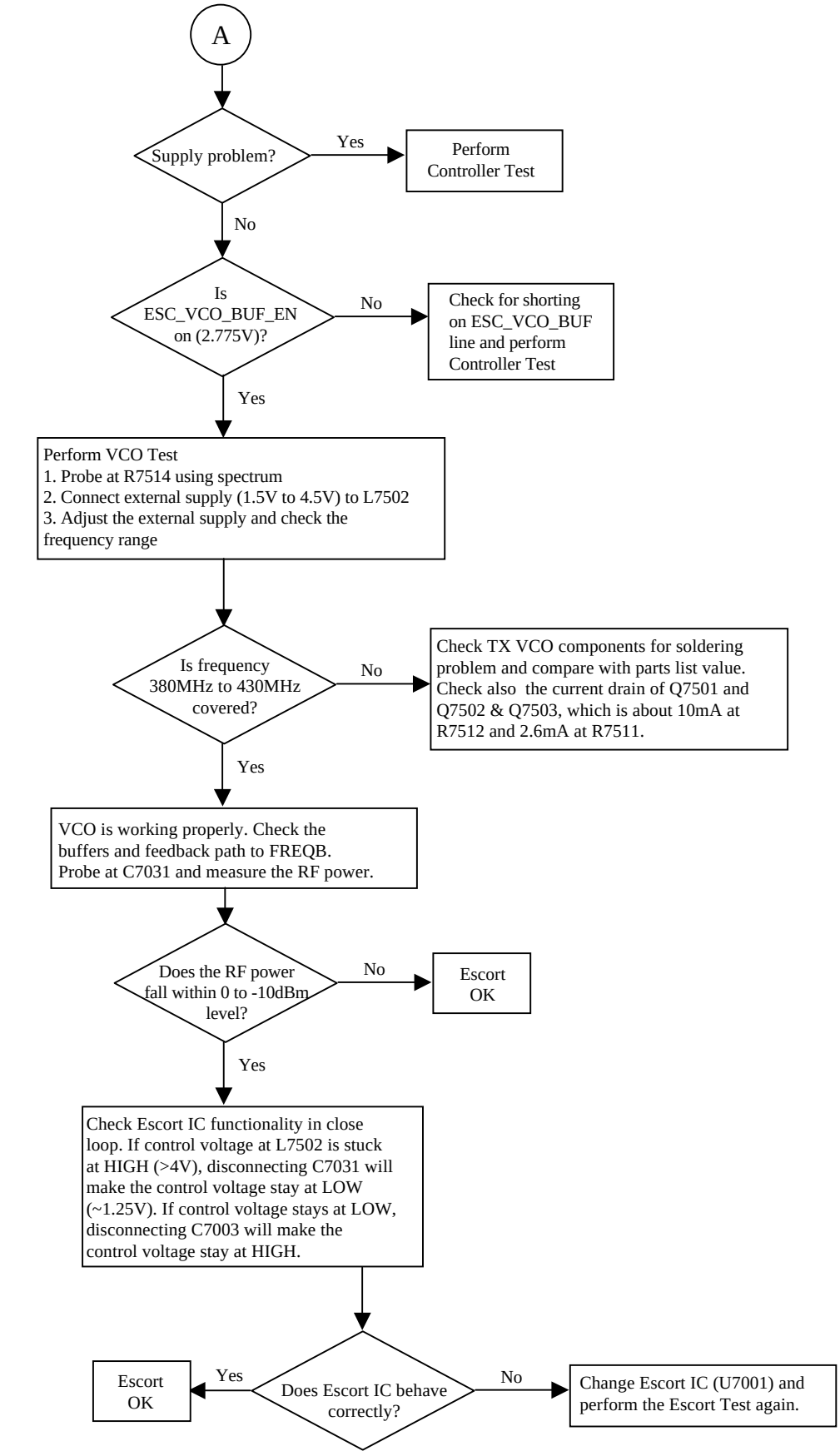
Receiver Troubleshooting



Escort Troubleshooting

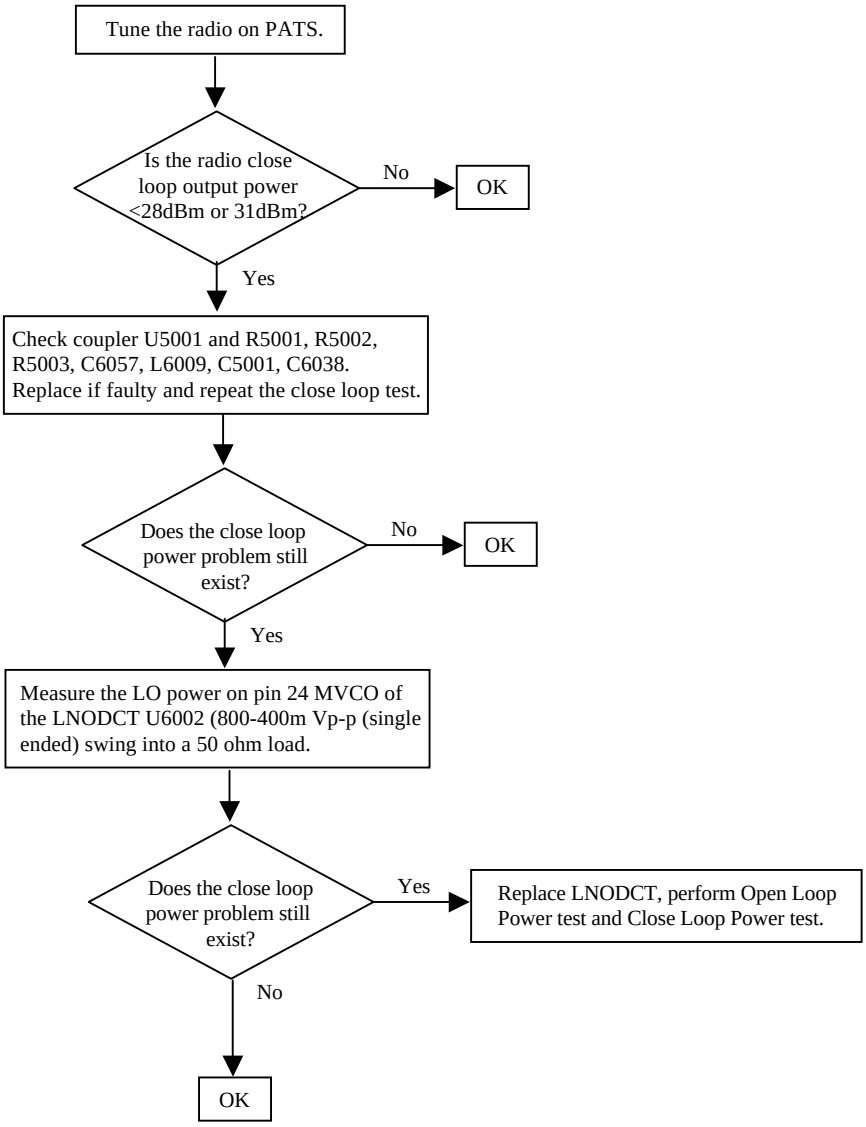

Perform the following:
1. Remove the Escort shield.
2. Visually check all components and solder connections around Escort IC
3. Set the Unit to RFTONE mode using TetraCom Commands shown.
4. Probe R7003 using spectrum to check for main VCO frequency.
TetraCom Commands (RFTONE mode)
>test_Enter
>11 timer on
>freq tx 405
>main_vco on
>escort 0c 1d c4
>offset_vco on
>vblin 00
>pa off
>ant_en off
>mode rftone
Is the frequency 518.90625MHz (405MHz*41/32) synthesized?
No
Perform Synthesizer Test
Yes
Is the Magnitude above -10dBm?
No
Yes
Check the DC voltage on Escort IC.
Is CPBIAS pin 13 0.9Volt and FREQA pin 16 has same voltage (2.2Volt) as FREQB pin 9?
No
Change Escort IC (U7001) and perform the Escort Test again.
Yes
Perform DC supply check
1. Check V1_3V at C7001
2. Check 5V_RF at C7021
A

Escort Troubleshooting (Cont.)


A
Supply problem?
Yes
Perform Controller Test
No
Is ESC_VCO_BUF_EN on (2.775V)?
No
Check for shorting on ESC_VCO_BUF line and perform Controller Test
Yes
Perform VCO Test
1. Probe at R7514 using spectrum
2. Connect external supply (1.5V to 4.5V) to L7502
3. Adjust the external supply and check the frequency range
Is frequency 380MHz to 430MHz covered?
No
Check TX VCO components for soldering problem and compare with parts list value. Check also the current drain of Q7501 and Q7502 & Q7503, which is about 10mA at R7512 and 2.6mA at R7511.
Yes
VCO is working properly. Check the buffers and feedback path to FREQB. Probe at C7031 and measure the RF power.
Does the RF power fall within 0 to -10dBm level?
No
Escort OK
Yes
Check Escort IC functionality in close loop. If control voltage at L7502 is stuck at HIGH (>4V), disconnecting C7031 will make the control voltage stay at LOW (~1.25V). If control voltage stays at LOW, disconnecting C7003 will make the control voltage stay at HIGH.
Does Escort IC behave correctly?
Yes
Escort OK
No
Change Escort IC (U7001) and perform the Escort Test again.

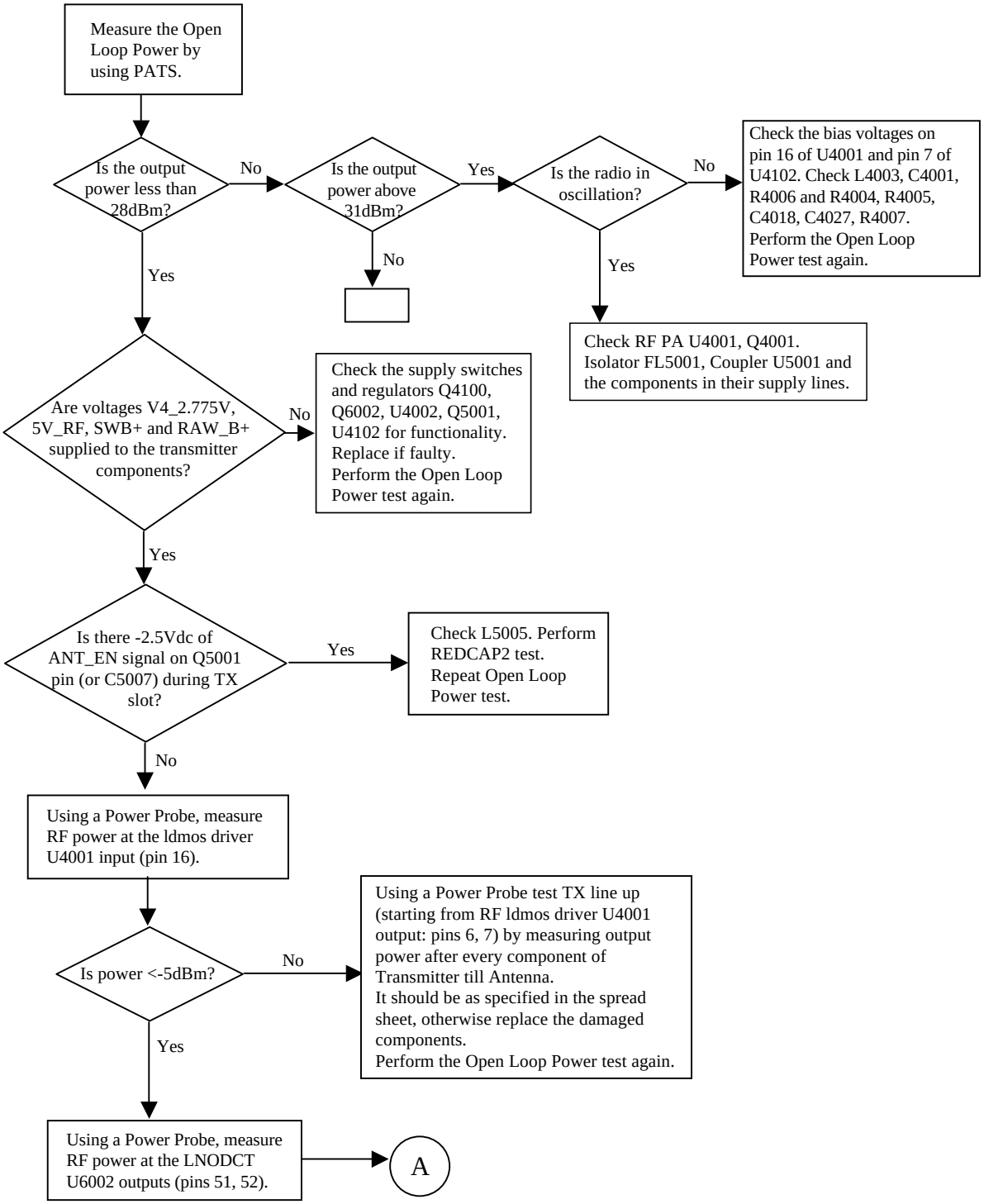
Closed Loop Power Test

This test should be carried out only after the successful completion of the previous tests.

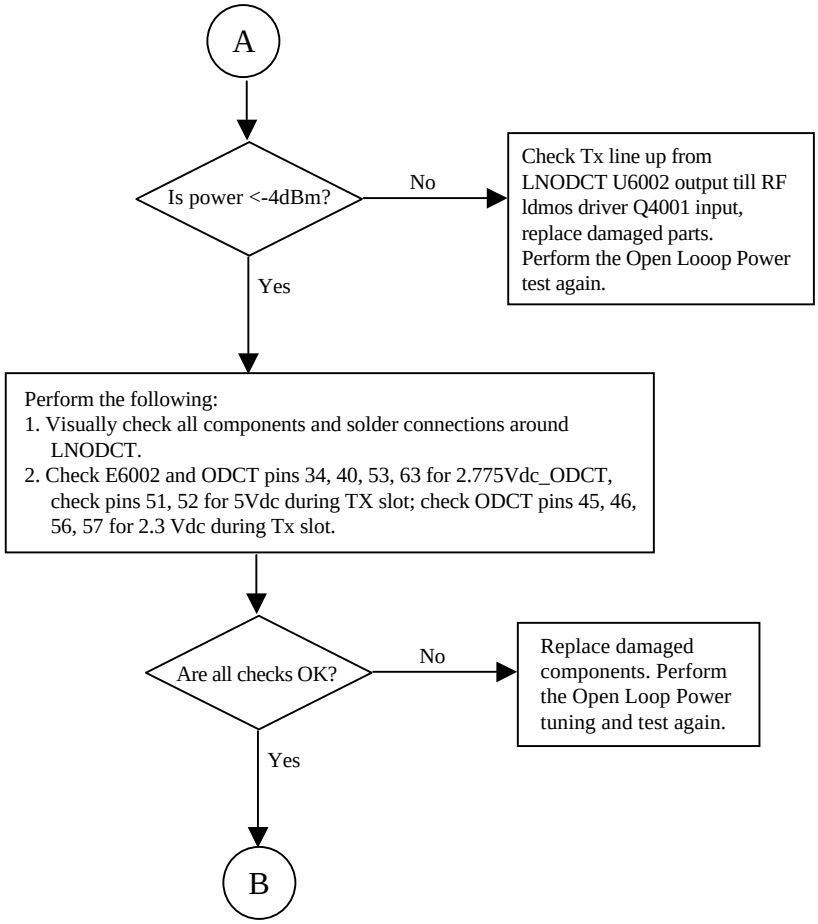

Tune the radio on PATS.
Is the radio close loop output power <28dBm or 31dBm?
No
OK
Yes
Check coupler U5001 and R5001, R5002, R5003, C6057, L6009, C5001, C6038. Replace if faulty and repeat the close loop test.
Does the close loop power problem still exist?
No
OK
Yes
Measure the LO power on pin 24 MVCO of the LNODCT U6002 (800-400m Vp-p (single ended) swing into a 50 ohm load.
Does the close loop power problem still exist?
Yes
Replace LNODCT, perform Open Loop Power test and Close Loop Power test.
No
OK

Open Loop Power Test

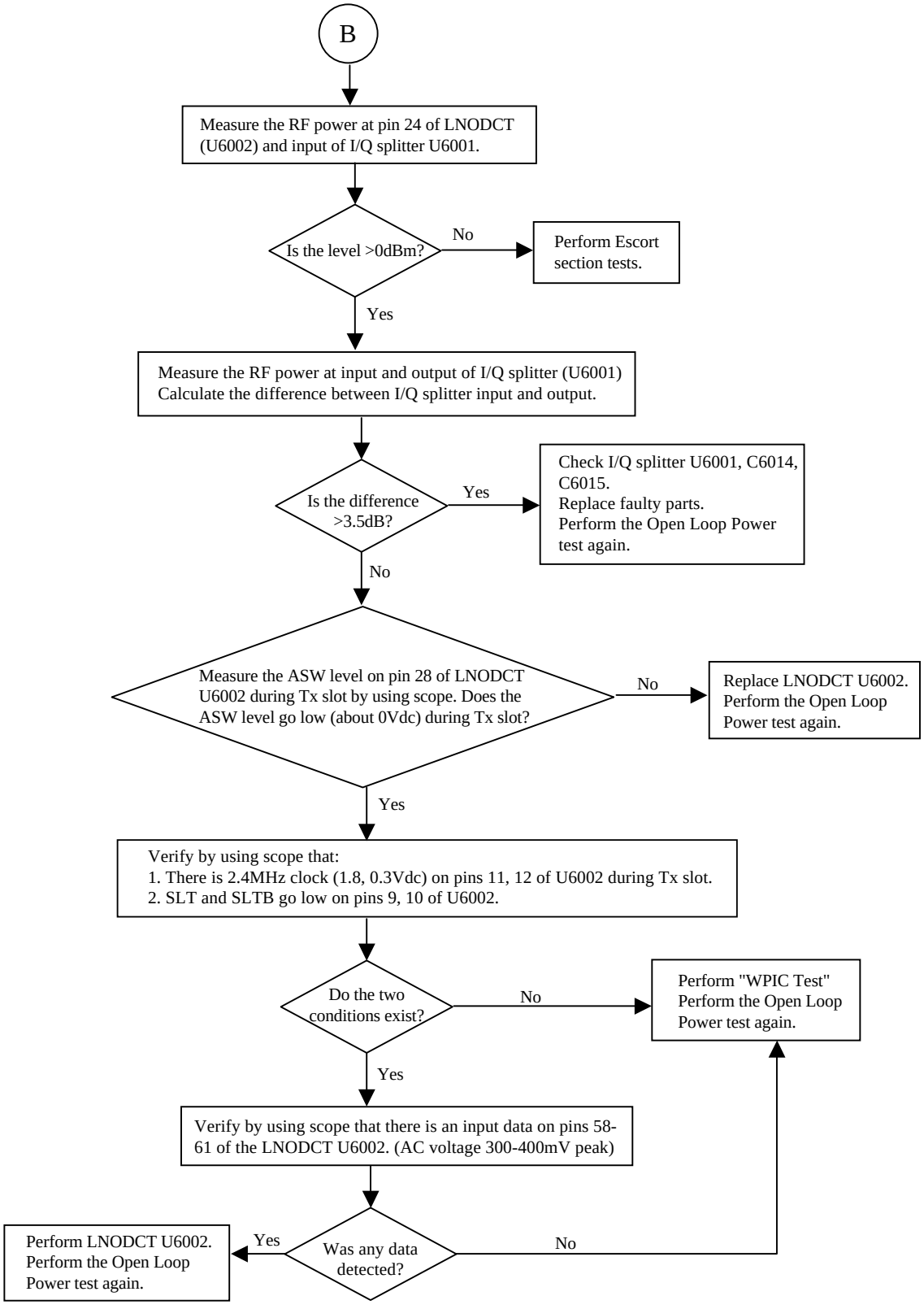
This test should be carried out only after the successful completion of the previous tests.


Measure the Open Loop Power by using PATS.
Is the output power less than 28dBm?
No
Is the output power above 31dBm?
Yes
Is the radio in oscillation?
No
Check the bias voltages on pin 16 of U4001 and pin 7 of U4102. Check L4003, C4001, R4006 and R4004, R4005, C4018, C4027, R4007. Perform the Open Loop Power test again.
Yes
No
Yes
Check RF PA U4001, Q4001. Isolator FL5001, Coupler U5001 and the components in their supply lines.
Are voltages V4_2.775V, 5V_RF, SWB+ and RAW_B+ supplied to the transmitter components?
No
Check the supply switches and regulators Q4100, Q6002, U4002, Q5001, U4102 for functionality. Replace if faulty. Perform the Open Loop Power test again.
Yes
Is there -2.5Vdc of ANT_EN signal on Q5001 pin (or C5007) during TX slot?
Yes
Check L5005. Perform REDCAP2 test. Repeat Open Loop Power test.
No
Using a Power Probe, measure RF power at the ldmos driver U4001 input (pin 16).
Is power <-5dBm?
No
Using a Power Probe test TX line up (starting from RF ldmos driver U4001 output: pins 6, 7) by measuring output power after every component of Transmitter till Antenna.
It should be as specified in the spread sheet, otherwise replace the damaged components.
Perform the Open Loop Power test again.
Yes
Using a Power Probe, measure RF power at the LNODCT U6002 outputs (pins 51, 52).
A

Open Loop Power Test (Cont.)

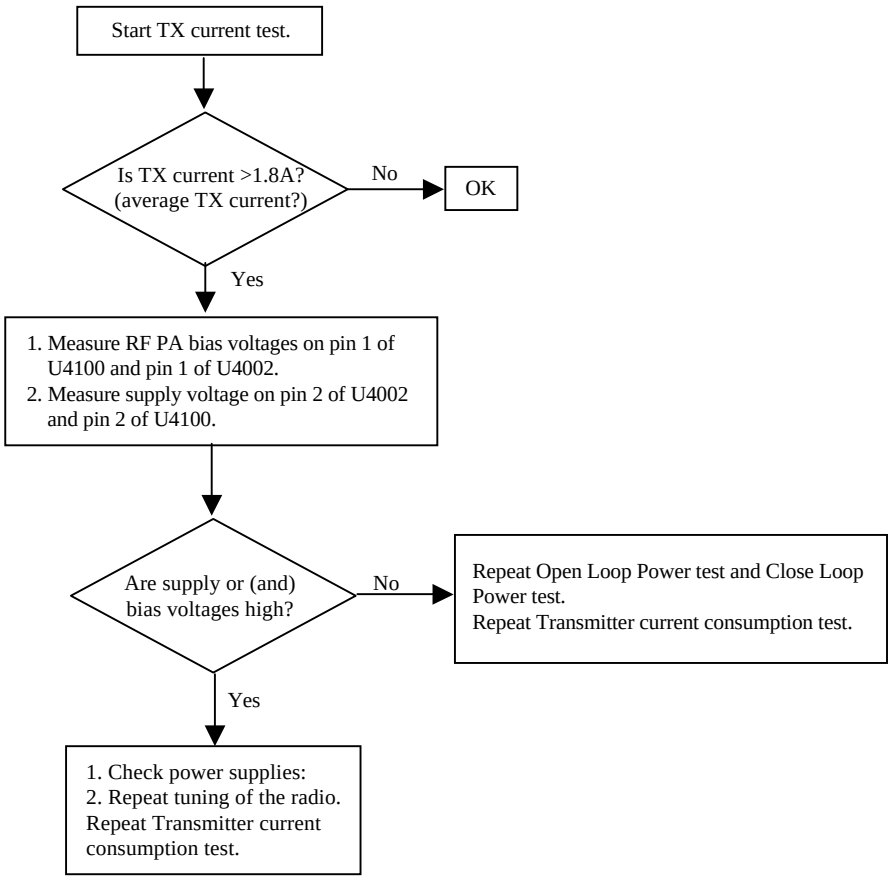

A
Is power <-4dBm?
No
Check Tx line up from LNODCT U6002 output till RF ldmos driver Q4001 input, replace damaged parts. Perform the Open Looop Power test again.
Yes
Perform the following:
1. Visually check all components and solder connections around LNODCT.
2. Check E6002 and ODCT pins 34, 40, 53, 63 for 2.775Vdc_ODCT, check pins 51, 52 for 5Vdc during TX slot; check ODCT pins 45, 46, 56, 57 for 2.3 Vdc during Tx slot.
Are all checks OK?
No
Replace damaged components. Perform the Open Loop Power tuning and test again.
Yes
B

Open Loop Power Test (Cont.)

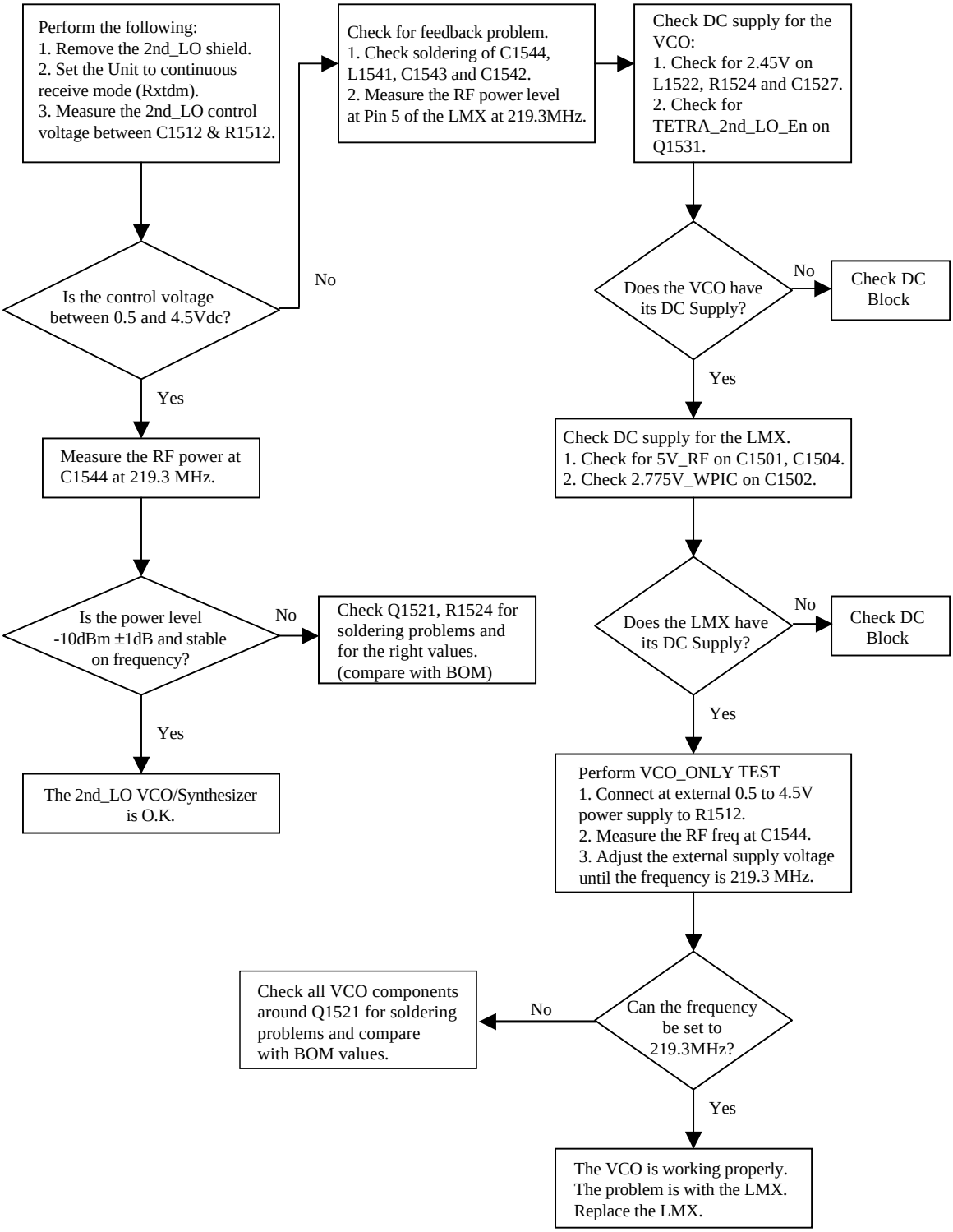

B
Measure the RF power at pin 24 of LNODCT (U6002) and input of I/Q splitter U6001.
Is the level >0dBm?
No
Perform Escort section tests.
Yes
Measure the RF power at input and output of I/Q splitter (U6001) Calculate the difference between I/Q splitter input and output.
Is the difference >3.5dB?
Yes
Check I/Q splitter U6001, C6014, C6015. Replace faulty parts. Perform the Open Loop Power test again.
No
Measure the ASW level on pin 28 of LNODCT U6002 during Tx slot by using scope. Does the ASW level go low (about 0Vdc) during Tx slot?
No
Replace LNODCT U6002. Perform the Open Loop Power test again.
Yes
Verify by using scope that:
1. There is 2.4MHz clock (1.8, 0.3Vdc) on pins 11, 12 of U6002 during Tx slot.
2. SLT and SLTB go low on pins 9, 10 of U6002.
Do the two conditions exist?
No
Perform "WPIC Test" Perform the Open Loop Power test again.
Yes
Verify by using scope that there is an input data on pins 58-61 of the LNODCT U6002. (AC voltage 300-400mV peak)
Was any data detected?
Yes
Perform LNODCT U6002. Perform the Open Loop Power test again.
No

Transmitter Current Consumption Test

This test should be carried out only after the successful completion of the previous tests.

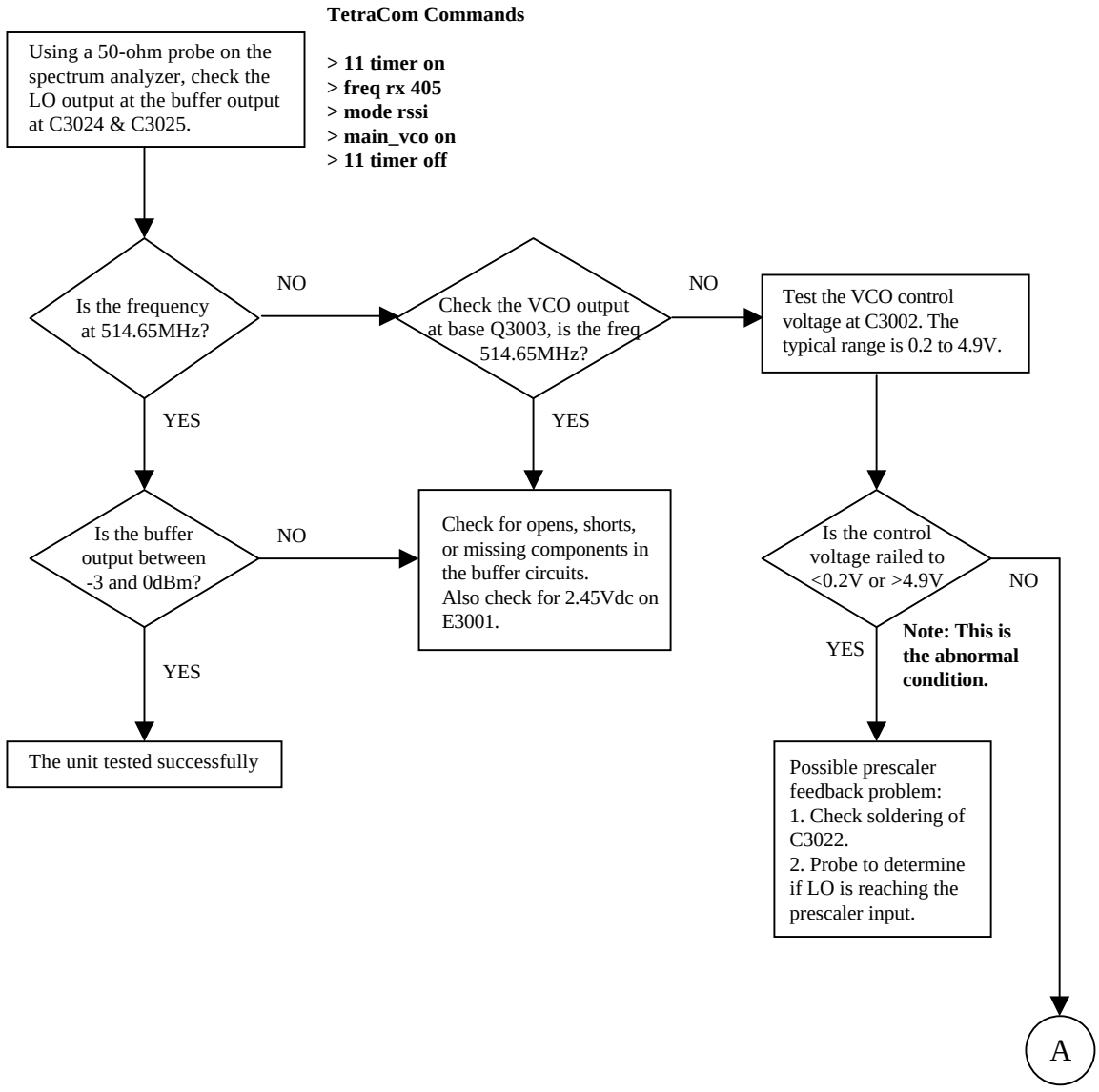

Start TX current test.
Is TX current >1.8A?
(average TX current?)
No
OK
Yes
1. Measure RF PA bias voltages on pin 1 of U4100 and pin 1 of U4002.
2. Measure supply voltage on pin 2 of U4002 and pin 2 of U4100.
Are supply or (and) bias voltages high?
No
Repeat Open Loop Power test and Close Loop Power test.
Repeat Transmitter current consumption test.
Yes
1. Check power supplies:
2. Repeat tuning of the radio.
Repeat Transmitter current consumption test.

2nd LO Troubleshooting

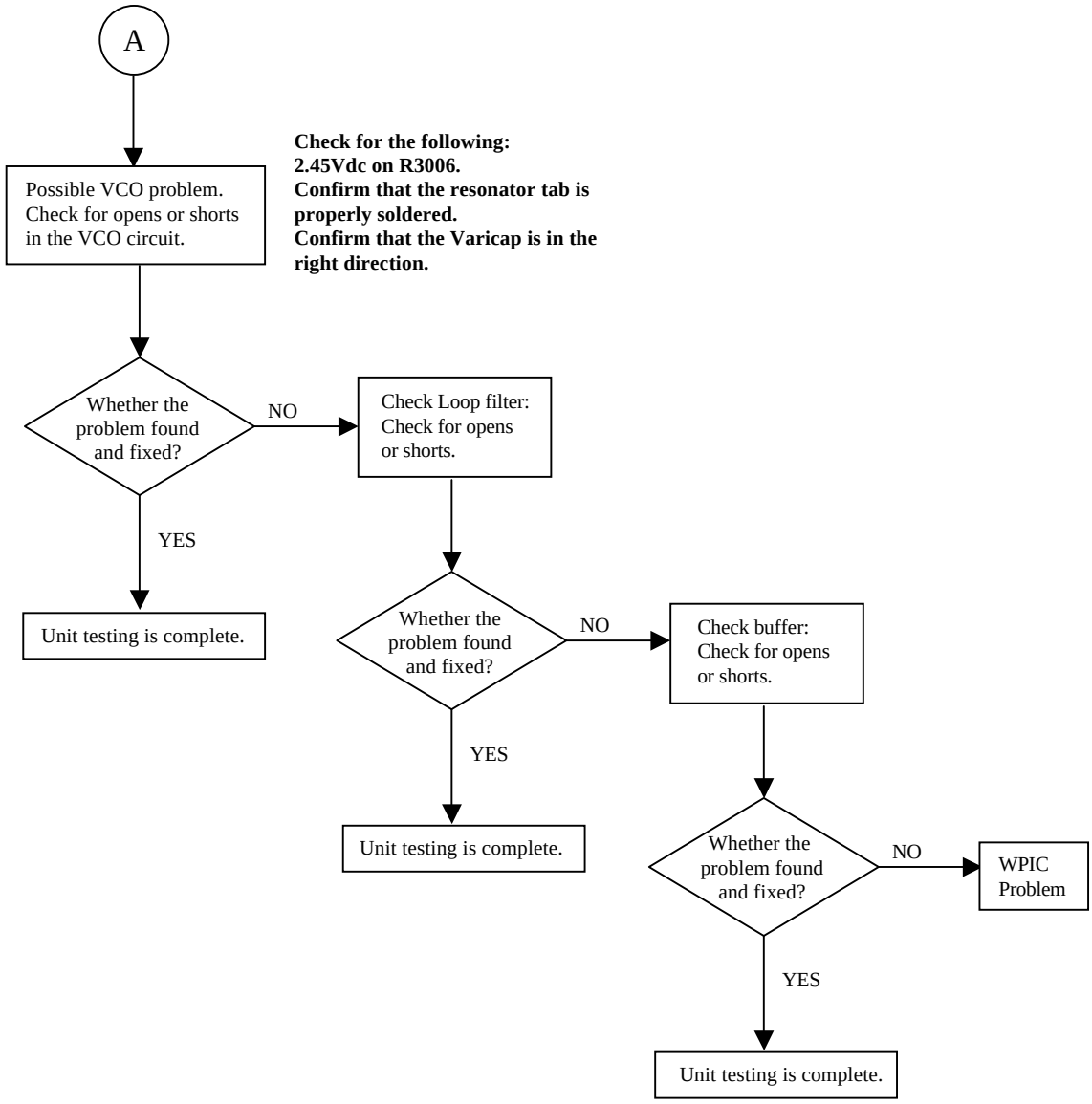

Perform the following:
1. Remove the 2nd_LO shield.
2. Set the Unit to continuous receive mode (Rxtdm).
3. Measure the 2nd_LO control voltage between C1512 & R1512.
Is the control voltage between 0.5 and 4.5Vdc?
No
Yes
Check for feedback problem.
1. Check soldering of C1544, L1541, C1543 and C1542.
2. Measure the RF power level at Pin 5 of the LMX at 219.3MHz.
Measure the RF power at C1544 at 219.3 MHz.
Is the power level -10dBm ±1dB and stable on frequency?
No
Check Q1521, R1524 for soldering problems and for the right values. (compare with BOM)
Yes
The 2nd_LO VCO/Synthesizer is O.K.
Check DC supply for the VCO:
1. Check for 2.45V on L1522, R1524 and C1527.
2. Check for TETRA_2nd_LO_En on Q1531.
Does the VCO have its DC Supply?
No
Check DC Block
Yes
Check DC supply for the LMX.
1. Check for 5V_RF on C1501, C1504.
2. Check 2.775V_WPIC on C1502.
Does the LMX have its DC Supply?
No
Check DC Block
Yes
Perform VCO_ONLY TEST
1. Connect at external 0.5 to 4.5V power supply to R1512.
2. Measure the RF freq at C1544.
3. Adjust the external supply voltage until the frequency is 219.3 MHz.
Can the frequency be set to 219.3MHz?
No
Check all VCO components around Q1521 for soldering problems and compare with BOM values.
Yes
The VCO is working properly.
The problem is with the LMX.
Replace the LMX.

Synthesizer & VCO Troubleshooting

Use this test on a unit with the following symptom: no Tx or Rx.


TetraCom Commands
> 11 timer on
> freq rx 405
> mode rssi
> main_vco on
> 11 timer off
Using a 50-ohm probe on the spectrum analyzer, check the LO output at the buffer output at C3024 & C3025.
Is the frequency at 514.65MHz?
NO
Check the VCO output at base Q3003, is the freq 514.65MHz?
NO
Test the VCO control voltage at C3002. The typical range is 0.2 to 4.9V.
YES
YES
Is the buffer output between -3 and 0dBm?
NO
Check for opens, shorts, or missing components in the buffer circuits.
Also check for 2.45Vdc on E3001.
Is the control voltage railed to <0.2V or >4.9V
NO
YES
Note: This is the abnormal condition.
YES
The unit tested successfully
Possible prescaler feedback problem:
1. Check soldering of C3022.
2. Probe to determine if LO is reaching the prescaler input.
A

Synthesizer & VCO Troubleshooting (Cont.)


A
Possible VCO problem. Check for opens or shorts in the VCO circuit.
Check for the following:
2.45Vdc on R3006.
Confirm that the resonator tab is properly soldered.
Confirm that the Varicap is in the right direction.
Whether the problem found and fixed?
NO
Check Loop filter: Check for opens or shorts.
YES
Unit testing is complete.
Whether the problem found and fixed?
NO
Check buffer: Check for opens or shorts.
YES
Unit testing is complete.
Whether the problem found and fixed?
NO
WPIC Problem
YES
Unit testing is complete.

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CHAPTER 4.2
TRANSCEIVER 800 MHz

General

This section provides a block diagram overview of the main Digital/RF Board. This is supplemented by the detailed block diagram and detailed circuit description.

Block Diagram Overview

The main Digital/RF Block contains the following four sections (see Figure 4.2-1). An overview of these four sections is provided in the following paragraphs:

- Receiver Section
- Transmitter Section
- Frequency Generating Section (Synthesizer)
- Digital & Audio Section

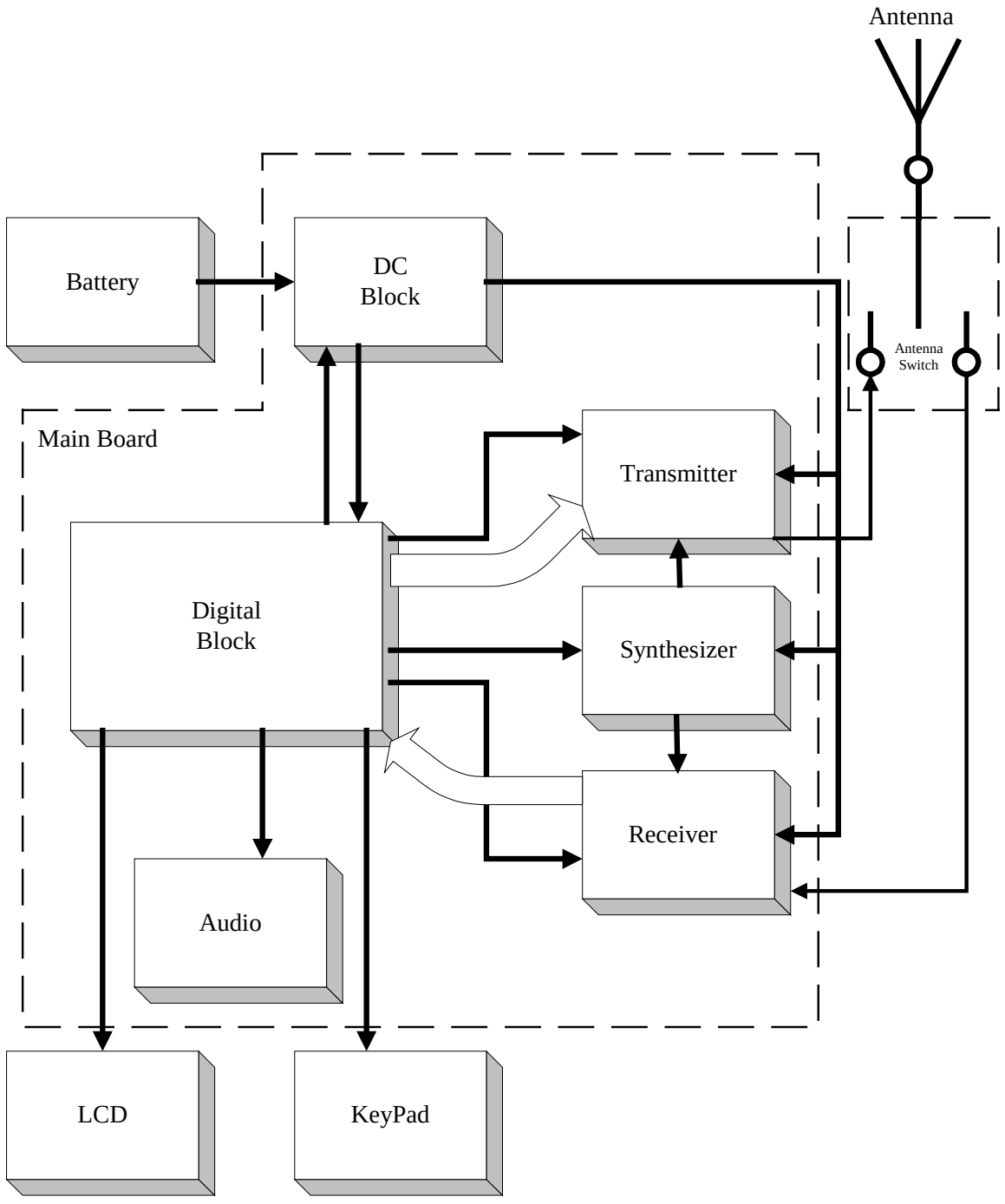

Figure 4.2-1 General Block Diagram

Receiver Section

The receiver section includes the following main components:

- Antenna Switch
- Limiter
- Front Filter (First Pre-selector)
- Low Noise Amplifier (LNA)
- Second Pre-selector
- Mixer
- IF Filter
- Balun
- WPIC

The Receiver Path implements an Automatic Gain Control (AGC). It is required to maintain good receiver linearity over a wide range of incoming signals and prevents clipping of high level signals.

The First Intermediate frequency (IF) circuit consists of the Mixer, IF Filter, and WPIC. The First IF is down converted to baseband using an analog mixer (high-side injection) located in the WPIC. An external second LO synthesizer IC is used to generate the required 219.3 MHz signal, which is further divided by two to 109.65 MHz before being applied to the mixer.

The WPIC performs the following functions:

- Carries out amplification and quadrature down conversion of the signal into baseband.
- Synthesizes the second VCO frequency.
- Performs IF AGC.
- Converts the baseband analog signal into digital I & Q formats.
- Synthesizes the receive and transmit data (ie Sigma-Delta) clock.
- Transmits the received data to the DSP.

Transmitter Section

The transmitter circuitry includes a linear class AB Power Amplifier (PA) for the linear modulation of the MTP700. It also includes a cartesian feedback loop to enhance its transmitter linearity and reduced splattering power into adjacent channels.

The transmitter path consists of a forward path and a cartesian feedback loop. The forward path includes the LNODCT (Low Noise Offset Direct Conversion Transmitter) ASIC, Balun, Attenuator, and Power Amplifier. The loop feedback path includes the directional coupler, attenuator and LNODCT.

The linearized power from the PA goes through the isolator which provides the isolation between the antenna and the PA. The signal then passes through the antenna switch and a lowpass Harmonic Filter to provide additional filtering to remove far out unwanted signals.

Frequency Generating Section

The frequency generating section contains the following components:

- TCXO REF. Oscillator.
- Main Synthesizer - consists of the WPIC's PLL and the Main Voltage Controlled Oscillator (VCO).
- 2nd Local Oscillator (LO) VCO together with the LMX Dual Synthesizer.
- Transmit PLL - consists of TX VCO together with ESCORT Synthesizer IC.

TCXO Reference Oscillator

All frequencies originate from the REF. oscillator -TCXO. This is a digital temperature compensated crystal oscillator producing an accurate and stable 16.8 MHz reference frequency. The 16.8 MHz reference frequency is divided in the WPIC and in the Dual Synthesizer to produce required reference frequency for the other synthesizers. The 16.8 MHz reference is also routed to GCAP3 to clock the digital circuits.

Main Synthesizer

The Main Synthesizer consists of the WPIC internal PLL modules, and Main VCO on board. It produces the LO signal to down-convert the receive signal to the first IF 109.65 MHz frequency and provides the transmit injection frequency for the ESCORT IC.

RX Second Local Oscillator (LO)

The second LO synthesizer supplies the second IF local oscillator frequency to the receiver. It produces 219.3 MHz that is divided by two in the WPIC in order to down-convert the received signal to the baseband.

Transmit PLL

The transmit PLL consists of the ESCORT IC and transmit VCO. The ESCORT IC receives the reference signal from the main synthesizer. The ESCORT IC which is another PLL together with the transmit VCO does the synthesis of the required transmitter signal.

Digital & Audio Section

The digital section includes the RedCap2 host micro-processor which is the controller of the Digital/RF Board. It controls the operation of the audio and transmitter, receiver, and synthesizer integrated circuits located in the RF section. It has the serial communication interface to communicate with the keypad, display and other internal peripherals.

For audio, the RedCap2 contains a Digital Signal Processor (DSP) which performs modulation and de-modulation functions for the radio. It also performs ACELP speech coding and Forward Error Correction.

Major components of the digital section are:

- RedCap2 (microprocessor with DSP embedded)
- GCAP3 (DC power supply and audio amplifier circuits)
- Serial peripheral interface (SPI)
- External host memories (Flash and SRAM)
- Keypad block & circuits
- LCD (liquid-crystal display) circuits.
- Bottom connector & side connector interface circuits

Block Diagrams Description

The block diagrams description cover Receiver Path, Transmitter Path, Frequency Generation Section and Digital Section.

Receiver Path

The received signal (see Figure 4.2-2) from the antenna is directed by the Antenna Switch to the Front End Filter

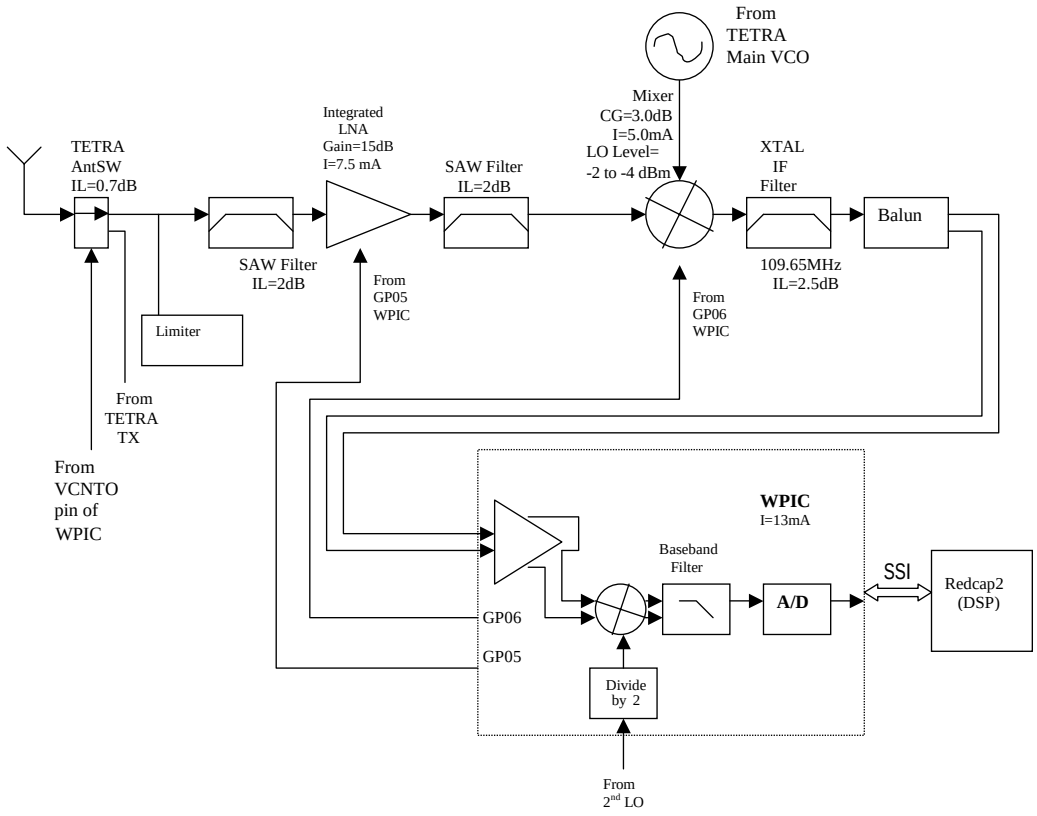

Figure 4.2-2 Receive Path - Block Diagram

The Front End Filter, which defines the receive frequency range, blocks the half IF and image frequency entry, and reduces the RF oscillator leakage. The signal is mixed with the local oscillator (high-side) to create the first IF at 109.65 MHz. The signal is filtered by the crystal filter and sent to the WPIC ASIC.

The WPIC performs down conversion to baseband frequency (0 Hz) and converts the baseband analog signals into digital-in-phase (I) and quadrature (Q) formats. This data is sent for further processing to the Digital Signal Processor (DSP) (part of RedCap2) over the Synchronous Serial Interface (SSI) data links.

The DSP performs: the demodulation, Forward Error Correction (FEC) and other correction algorithms for overcoming channel errors, and decoder procedure for digital speech data decompression.

Transmitter Path

When the radio is transmitting (see Figure 4.2-3), the microphone audio is sent to the GCAP3 (CODEC). The CODEC performs 13-bit analog-to-digital conversion and the digital signal is routed to the DSP (part of RedCap2). The DSP performs coding, Error Correction and modulation. From the DSP, the signal is sent to the WPIC.

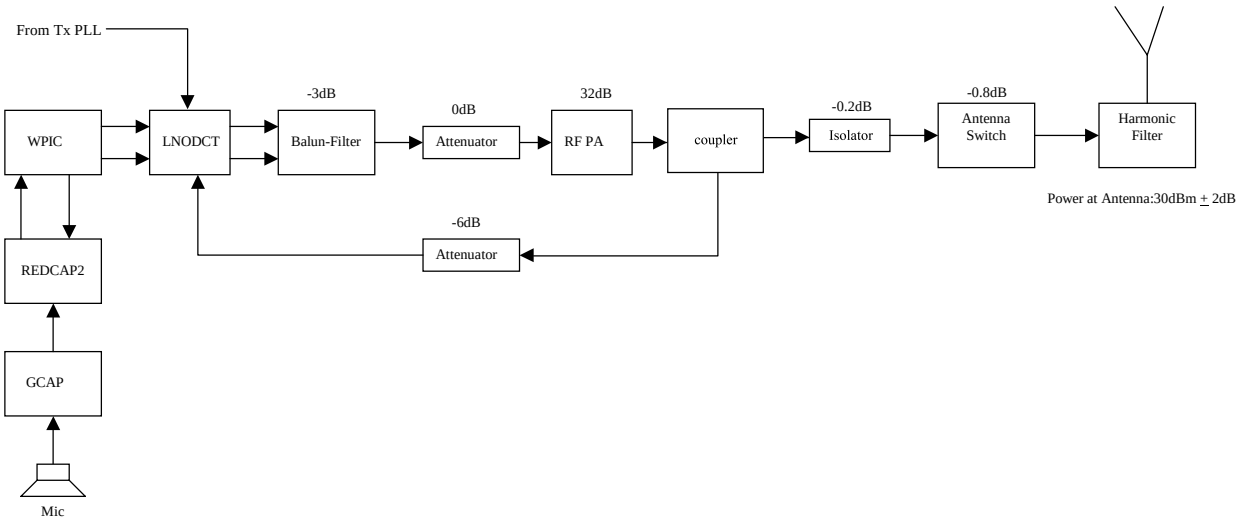

Figure 4.2-3 Transmit Path - Block Diagram

In the WPIC, the digital baseband I & Q signals are converted into corresponding analog signals. These signals are also filtered. From the WPIC, I & Q signals are injected to the LNODCT. In the LNODCT the data is mixed with RF signal.

From the differential output of the LNODCT the modulated RF signal is injected to the Balun-Filter, that transforms the differential input into single output, and then it is routed to the antenna via the Antenna Switch.

The feedback signal is used for power control.

Frequency Generating Section

The frequency generating section contains the following components (see Figure 4.2-4):

- TCXO REF. Oscillator.
- Main Synthesizer - consists of the WPIC's PLL and the Main Voltage Controlled Oscillator (VCO).
- 2nd Local Oscillator (LO) VCO together with the LMX Dual Synthesizer IC.
- Transmit PLL - consists of TX VCO together with ESCORT Synthesizer IC.

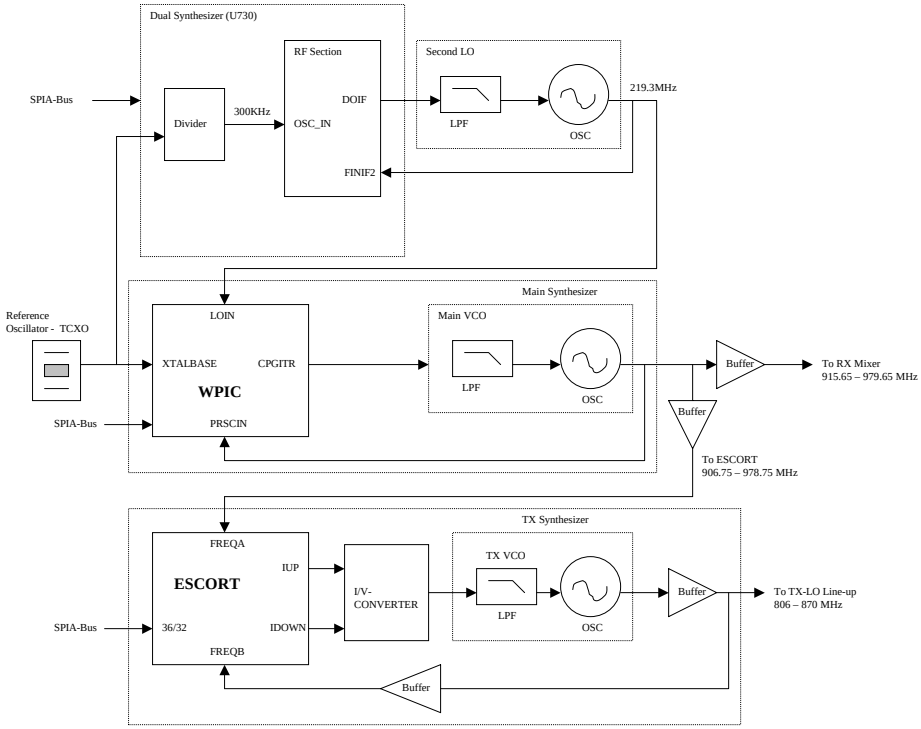

Figure 4.2-4 Frequency Generation - Block Diagram

TCXO Reference Oscillator

All frequencies originate from the REF. oscillator - TCXO. This is a digital temperature compensated crystal oscillator producing an accurate and stable 16.8 MHz reference frequency. The 16.8 MHz reference frequency is divided in the WPIC and in the Dual Synthesizer to produce required reference frequency for the other synthesizers. The 16.8 MHz reference is also routed to GCAP3 to clock the digital circuits.

Main Synthesizer

The Main Synthesizer consists of the WPIC internal PLL modules and an external, discrete Main VCO on board. It produces the LO signal to down-convert the receive signal to the first IF 109.65 MHz frequency and provides the transmit injection frequency for the ESCORT IC.

RX Second Local Oscillator (LO)

The second LO synthesizer supplies the second IF local oscillator frequency to the receiver. It produces 219.3 MHz that is divided by two in the WPIC in order to down-convert the received signal to the baseband.

Transmit PLL

The transmit PLL consists of the ESCORT IC and transmit VCO. The ESCORT IC receives the reference signal from the main synthesizer. The ESCORT IC which is another PLL together with the transmit VCO does the synthesis of the required transmitter signal.

Digital & Audio Section

The digital section (see Figure 4.2-5) contains the radio's RedCap2 RISC processor, DSP (embedded within), external memories and GCAP3. The DSP has its own processing memory. GCAP3 contains switching and linear regulators, audio preamplifiers, 13-bit CODEC, A/D and D/A Converters, and interfaces with an external Audio Amplifier for receive audio.

RedCap2 controls the receive/transmit frequencies, power levels, display, keypad, accessories, MMI, and other radio functions. This microprocessor can be operated through the RS232 interface by a personal computer to program the Flash memory with firmware and codeplug.

The DSP performs the functions of audio filtering, ACELP speech coding, Forward Error Correction and digital modulation. The GCAP3's CODEC handles the analog-to-digital and digital-to-analog conversions on audio signals.

The power distribution is supported by the Global Control Audio Power (GCAP3) IC. This IC supplies power to the radio using step-down PWM regulator supplying 1.875 VDC to the RedCap2 core, supplying V3 linear regulator 2.775VDC to the external memories, display and RedCap2 peripheral modules, supplying V2 to GCAP3 internal logic, internal audio amplifier and A/D converter. The regulator's power-down mode is controlled by the RedCap2, which senses the ON or OFF condition.

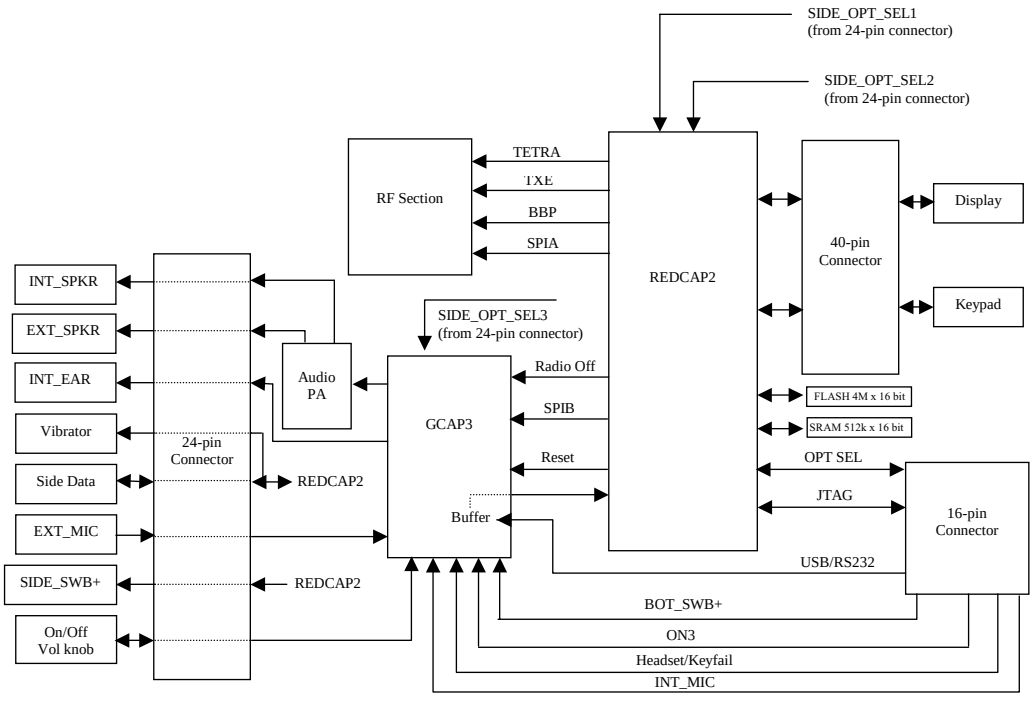

Figure 4.2-5 Digital Section - Block Diagram

Detailed Circuit Description

Receiver Path, Detailed Circuit Description

See Figure 4.2-6

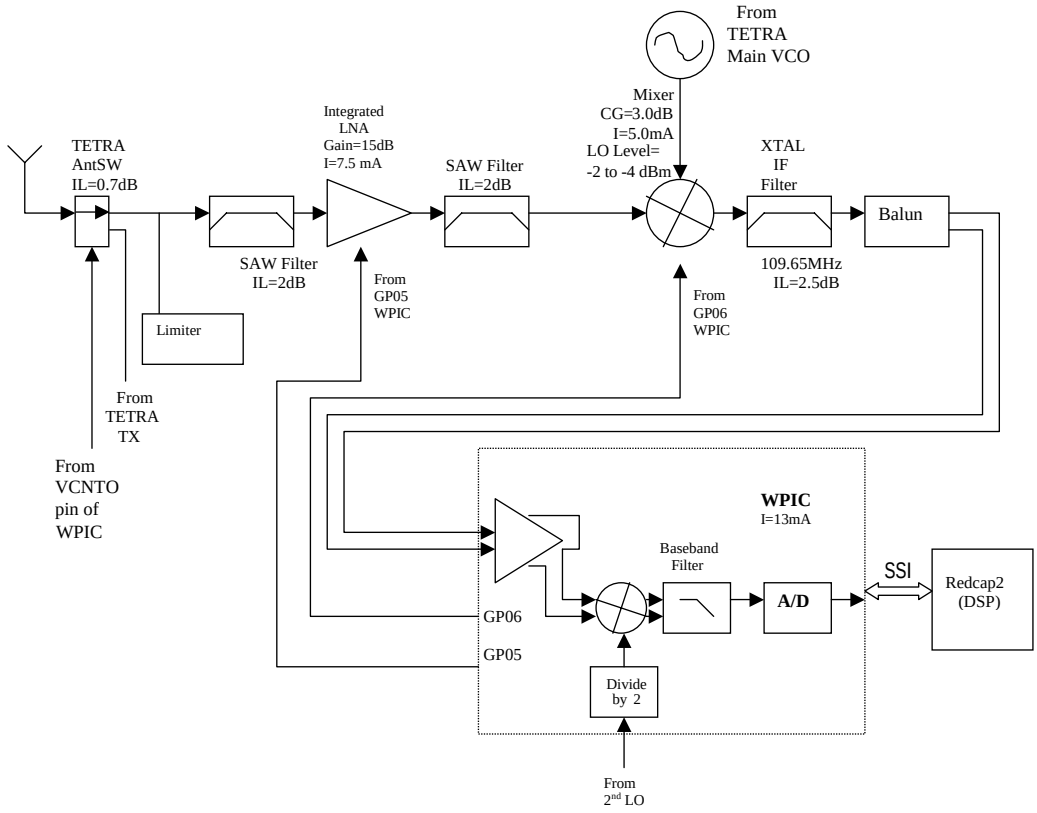

Figure 4.2-6 Receive Path Circuit Diagram

Antenna Switch

The signal coming from the antenna is routed to the receiver section via the harmonic filter, which is comprised of C943, L912 and C944. The signal continues to flow through L915 and C940, to the Rx section, toward limiter diode D500. The attenuation of wanted signal is typically 0.7dB.

Limiter

The limiter (D500) function is to limit the signal levels of signal with power higher than 5dBm, which may damage the receiver front-end. L500 resonates out the diode stray capacitance.

Front Filter (First Pre-selector)

The signal arriving from the limiter is routed through the front SAW filter (FL500) into the Low Noise Amplifier (LNA) (U500) via a matching network C500, L501 and C501.

The front filter is also called the 1st pre-selector and is used to attenuate the incoming parasitic RF frequencies, especially the image frequency. The Insertion Loss (IL) is typically 2dB.

Low Noise Amplifier (LNA)

The LNA (U500) amplifies the RF signal. The LNA gain including output matching circuit, L502, R502 and C514, is typically 15dB. Because the LNA is the first amplifier in the line, it is important that it will maintain large gain and small Noise Figure.

The LNA has an “enable” pin (pin 3) which is called VPD. When this pin receives a supply of 2.7 V from DC switch (Q500), the amplifier is enabled (controlled by GP05_DCLICP from WPIC). The LNA current is controlled by R500. Resistor R502 ensures the amplifier is stable through out its operating range. From the LNA the signal passes to second pre-selector, SAW filter (FL501).

Second Pre-selector

The 2nd Pre-selector (FL501) is another SAW filter which attenuates the non-linear products of the LNA and also the image product. Its IL is typically 2dB. From the output of the 2nd SAW filter the received signal is routed to the Mixer RF input via a LC match.

Mixer

The Mixer (U502) function is to down convert the incoming RF signal into IF signal (109.65 MHz). The mixer IC consists of a mixer and LO injection buffer.

The RF signal enters the Mixer at pin 4, and the IF is produced at pin 6. The LO (from the main VCO) signal passes via low pass filter FL503 and R514 into the IC at pin 3. The LO power is boosted internally by the mixer IC’s injection amplifier before being applied to the mixer. The LO buffer output choke, L513, is used to resonate out the chip internal capacitance, allowing a high injection signal into the mixer. The mixer IF current is partly controlled by R511 and R510. R511 controls the mixer gain while C528 provides RF bypass. The LO power at the LO mixer input is -2dBm to -4dBm. The 2.7V DC is supplied by switch Q501 (controlled by GP06_DCLICIN from WPIC).

The mixer conversion gain is about 3dB.

An impedance matching net is placed between the mixer and the IF filter (FL502). It consists of L514, C534, C535, C537, L509, R516 and C538.

IF Filter

The IF signal is routed via the IF filter (FL502), which has IL of 2.5dB and attenuates parasitic products of the mixer. It is connected via an impedance matching network that consists of C539, C540 and L510 to the Balun.

Balun

The Balun transforms the single ended input RF signal to a differential double-ended output. It consists of L507, C523, C522 and L508.

The differential signal is routed to the WPIC (World Phone IC) at pins A4 and B4 (PREINI and PREINIB) via C651 and C652.

WPIC (Receiver Back End Section)

The differential IF signal is amplified and converted down to baseband signal inside the WPIC (World Phone IC) by the 2nd LO signal. The 2nd LO signal is routed to the WPIC at pin D1 and divided by two into the quadrature generator block of the WPIC. The baseband signal from the mixer passes to an amplifier baseband filter array. The amplified and filtered signal is passed to the WPIC A/D converter. This A/D converter digitises the analog differential signal as I and Q components. The I and Q components appears as serial data on the WPIC_SRD line whenever the RX_ACQ line is high. The WPIC_SRD data is clocked into the DSP baseband port using a clock signal (WPIC_TXCLK) from WPIC. The DSP performs the functions of digital de-modulation. The WPIC is controlled via SPIA_MOSI, SPIA_CLK and SPIA_CS0_WPIC from RedCap2.

An internal AGC that is controlled by a control unit, establishes an appropriate attenuation for unwanted signals as well as an appropriate gain for wanted signals. The voltage at external capacitor C612 indicates the AGC attenuation level for the different input signal levels. The voltage at the capacitor varies from 1.3V to 2V as a function of the power of the received signal.

Transmitter Path, Detailed Circuit Description

See Figure 4.2-7

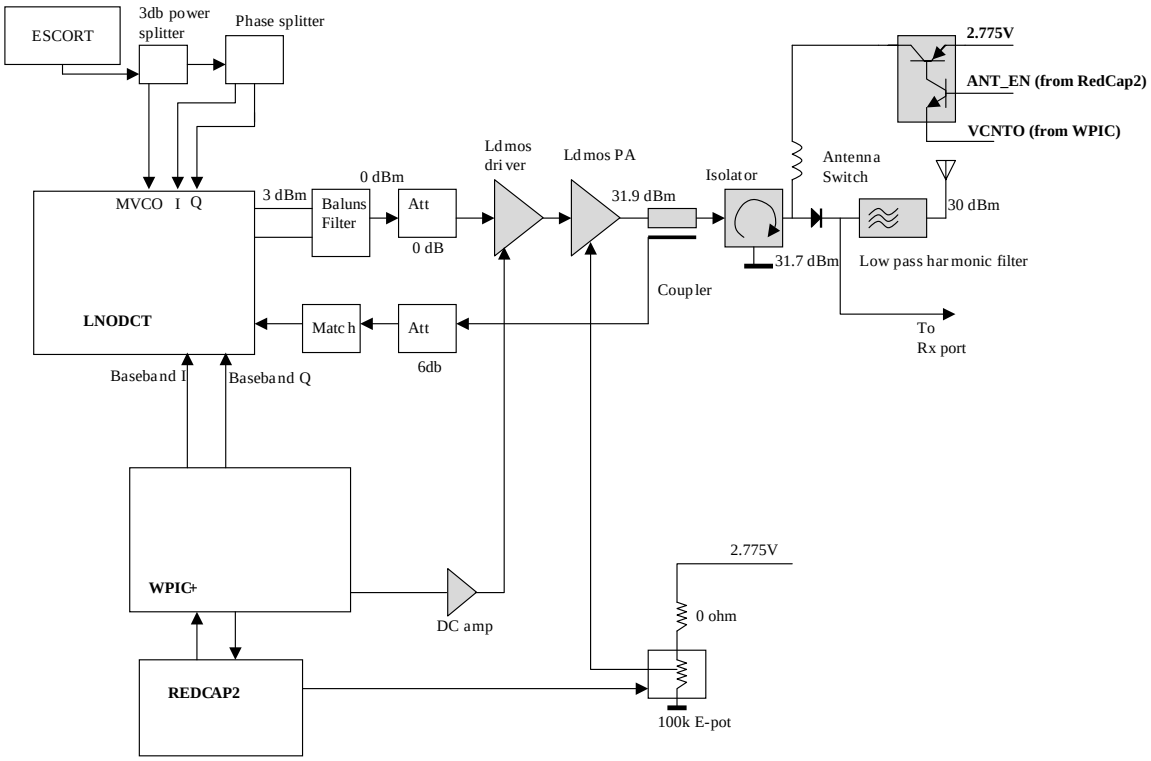

Figure 4.2-7 Transmit Path - Circuit Diagram

Forward Path

WPIC

The WPIC (World Phone IC) U601 receives serial data that is transmitted by the RedCap2 at a 48 ksps (kilosamples/second) rate to the SSI port (pin K10, WPIC_STD). Data is transmitted as a 16-bit ‘I’ word followed by a 16-bit ‘Q’ word. The WPIC provides a serial clock of 4.8MHz to the RedCap2 (pin K11, WPIC_TXCLK) and sends a frame sync signal (pin L11, WPIC_FSYNC) at the beginning of every ‘I’ word transmission to instruct the RedCap2 to send data. In the WPIC, the received serial I & Q words from the RedCap2 are converted into parallel I & Q words, and transferred to an interpolating filter. The interpolating filter increases the sampling rate to reduce in-band quantization noise, as well as to reduce image at multiples of the input data. The interpolated samples are rounded to 8 bits, and run through the 8-bit D/A converters. The D/A converters take the digital I & Q words and convert them into analog signals, which are then filtered and amplified. The output is comprised of two separate low-level differential signals, I & Q (pins A8, OUTQ; C8, OUTQB; D8, OUTI; A9, OUTIB). A differential output is used to minimize the noise pick-up, due to its inherent common mode rejection. The output signals are routed to the LNODCT IC where the transmitting loop is closed.

The WPIC sends a 2.4MHz low-level differential reference clock signal (pins B11, TCLK; C10, TCLKB) to the LNODCT. It also sends a differential signal (pins A11, TSLOT; A10, TSLOTB) that marks the beginning and the end of each transmission time slot (whenever pin 8, WPIC_TXE signal is received from the RedCap2). After receiving the TSLOT signal, the LNOCDT toggles the ASW line (pin J5) which signals the WPIC to set VCNTO signal LOW (pin J6) which enables the Antenna Switch during transmit time.

TX LO Line-Up

The TX LO line-up includes the ESCORT IC which generates a signal of frequency equal to the transmit frequency. The signal level is about +7dBm. This is then split thru a 3dB power splitter consisting of R457, R458 and R459.

One output of the power splitter U801 (MVCO signal) goes into the LO input of the LNODCT downconverter. This signal downconverts the RF feedback input signal to baseband.

The other output of the power splitter (MVCO_PS signal) goes into the phase splitter which generates I and Q signals for the upconverter in the LNODCT. These signals upconvert the baseband signal into RF frequency.

LNODCT

The LNODCT (Low Noise Offset Direct Conversion Transmitter) U803 is the heart of the transmitter.

The differential baseband signals from the WPIC are inputted into the LNODCT on pins 58 – 61 (BINQB, BINQ, BINIB and BINI). They pass through a variable attenuator and then they are summed with the down converted I & Q feedback. The baseband signal is then amplified and sent to the up-mixer.

The up-mixer consists of two mixers, one for the I channel and the other for the Q channel. The split I & Q LO signal is mixed with the baseband I & Q signals to produce an I and Q modulated signals at RF frequency. The signal is then output differentially on pins 51 and 52 (RFOUTB, RFOUT).

Balun - Filter

The differential RF signal is converted to a single-ended (unbalanced) signal by passing the Balun-Filter T800 (balanced-unbalanced filter). The Balun-Filter has a 200 Ohm input and 50 Ohm single-ended output. The Balun-Filter output voltage amplitude is two times higher than the differential voltages amplitudes. Thus the LNODCT output signal is increased by 6dB when compared to each of the differential signals. The insertion loss of the Balun-Filter is 3dB.

Resistors R921 - R923 form an attenuator to compensate for changes in the foward path RF PA gain stages.

RF Power Amplifier

The signal is routed through DC coupling capacitor C901 to the RF power amplifier (PA). The PA consists of 2 devices, namely U800 driver and Q800 final PA. U800 is a 2-stage IC that is capable of amplifying the signal to about 24dBm level. The capacitors and inductors between U800 output and Q800 input form a high pass - low pass matching network. Q800 output is then matched to the 50 ohms input of the isolator thru a low pass pi matching stage using microstrips.

The U800 amplifier gain is set in the factory using the VBLIN signal (from WPIC). The VBLIN voltage is amplified via a DC amplifier U907. Output voltage from U907 sets the quiescent current, and hence the gain of the LDMOS driver IC.

The gain of the final stage PA is set in the factory through serial SPI commands (from RedCap2) to the E-pot. The output of the E-pot is dependent on the resistance divider ratio internal to it. During transmission, the 2.775V supply to the E-pot is enabled using PA Bias line signal (from RedCap2). When this line signal goes to 2.775V (HIGH), the voltage to bias the final stage device is enable.

Coupler and Feedback Path

A coupler U806 exists at the RF PA output, it is used to pass the signal to Isolator FL801 and sample the signal thus providing the necessary feedback for the linearization and feedback correction. The sampled signal is routed via attenuator R913, R914, R915 to the LNODCT (pin 37, RFIN). The feedback signal is then mixed down to baseband in a quadrature down mixer, amplified and summed with the baseband input signal. The loop is closed.

Isolator

The signal in the forward path is fed to pin 1 of the isolator (FL801). The isolator is placed at the PA output to decrease the influence of the antenna impedance variation on the PA performance. The reflected power returned from the antenna, is absorbed in a 50 Ohms resistor inside the isolator. The isolator also protects the Cartesian loop from sudden VSWR variations that could lead to loop instability.

Antenna Switch

The RF signal from the Isolator is applied to PIN diodes D901 and D903. The PIN diodes are turned on during the transmission time slot, and the DC current flows through the Isolator to the ground. The RF signal is routed thru the harmonic filter (C943, L912 and C944) to the antenna.

In the Receiving mode the PIN diodes are turned off, the input RF signal is directed to the receiver path via $\lambda/4$ LC equivalent circuit (C943, L915 and C938).

The condition of the PIN diodes is controlled by the voltage switch Q806 by applying the ANT_EN signal (from RedCap2) to the switch. The resistor R911 determines the DC current through PIN diodes. Pin diodes D802 and D803 provide the additional capacitance so as to improve isolation to receiver path during transmission mode. Capacitors C939 and C931 compensate the parasitic inductance of D802 and D803 respectively. The VCNTO signal applied to the voltage switch Q806 is set LOW during the Receiving and Transmission modes.

The RF output signal is disabled during the CLCH (Training) mode by setting the VCNTO signal HIGH thus providing the low output power during the training slot.

Harmonic Filter

From the antenna switch the signal is routed to a one section of LC filter, consisting of the coil L912 and capacitors C943 and C944. The filter is required to attenuate the harmonics of the amplifying stages at the transmission path, and the Local Oscillator leakage at the receiver path.

Resistor R809 is added to provide a discharge path for any static electricity buildup at the antenna.

Frequency Generating Section, Detailed Circuit Description

See Figure 4.2-8

This section describes the generating circuits that supply all the required frequencies for the required transmitter and receiver functions. These circuits are described as follows:

- TCXO REF. Oscillator.
- Main VCO and Main Synthesizer.
- Second LO VCO and Dual Synthesizer RF section.
- Transmit PLL - TX VCO with the ESCORT Synthesizer IC.

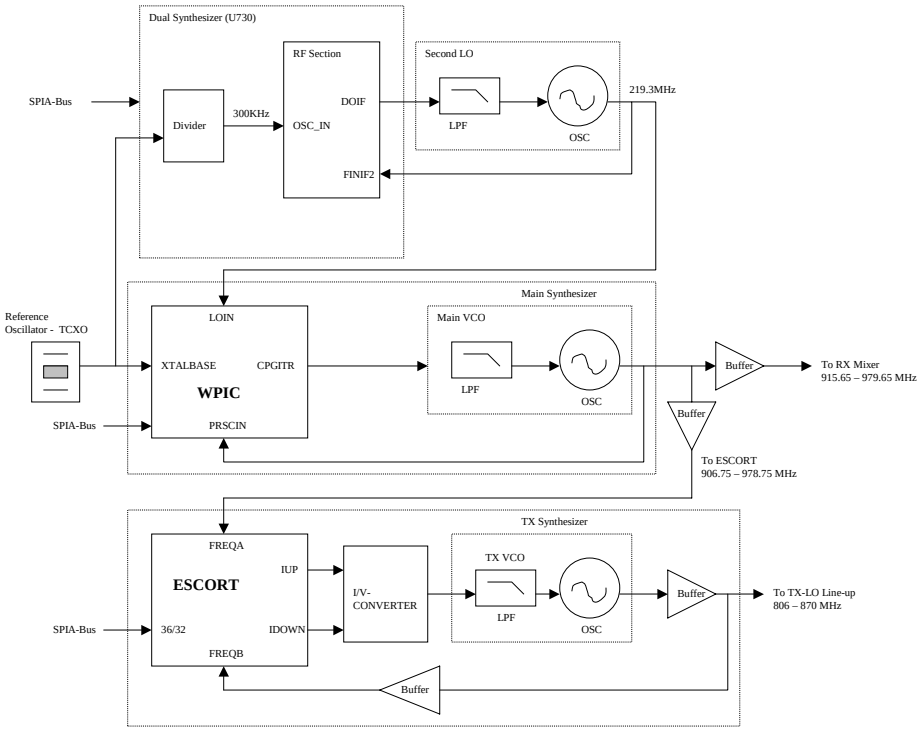

Figure 4.2-8 Frequency Generation Section - Block Diagram

TCXO Reference Oscillator

The TCXO is the reference frequency source for all the radio synthesizers. The output of the oscillator is a 16.8 MHz stable temperature compensated reference clock. This oscillator's centre frequency is adjustable by means of a PWM DAC (256 steps) to warp the radio frequency in order to lock to the base station. This 16.8 MHz signal is present at pin 3 of the TCXO, and is routed into the following devices:

1. To WPIC's K6 XTALBASE pin. The signal is divided by 2 to produce the 8.4 MHz reference signal, which is used for the Main PLL synthesizer.

2. To LMX Dual Synthesizer's OSC_IN pin via C731. The signal is divided to produce the 300 KHz reference signal for the second LO.

The reference signal is also routed from WPIC's pin F10 (16.8_MHz_CLK) to GCAP3 (and subsequently to RedCap2) to clock the digital circuits.

Main VCO and Main Synthesizer

The main synthesizer components are WPIC, Loop Filter, VCO and buffer. It produces the LO signal.

The main synthesizer functions are as follows:

- To serve as the local oscillator for the mixer of the receiver. It is used to down-mix the RF frequency to 1st IF (109.65 MHz).
- To provide reference for the transmit frequency PLL
- To serve as the WPIC feedback signal for locking the main synthesizer.

The WPIC is programmed by the DSP through the SPI bus.

The VCO (Q700 and associated circuitry) generates the LO signal which is fedback to the synthesizer (inside the WPIC) through the PRSCIN. The TCXO provides the 16.8MHz reference frequency.

The synthesizer then generates the VCTRL tuning voltage through WPIC's CPGITR pin to control the VCO frequency. The Loop FIlter (LPF) consists of C641, R624, R623, which filters noise in the tuning voltage.

The Q702 and Q459 buffers prevent loading and interference to the next stage - ie RX Mixer and ESCORT respectively.

LMX - Dual Synthesizer

The U730 (LMX233XL) is an integrated dual frequency synthesizer that includes prescalers. It is used with the second LO VCO at the RF section.

The LMX uses the 16.8 MHz from the TCXO for the synthesizers and divides the TCXO frequency into 300 kHz reference frequency for the 2nd LO.

Second LO VCO

The Second LO VCO is a discrete VCO (Q730) that is controlled by the LMX Dual Synthesizer IC (U730).

The VCO produces a frequency of 219.3 MHz, that routes into WPIC's pin D1 (LOIN). This signal is further divided by two before being applied to the second mixer in the WPIC.

The output signal of the VCO is also routed via the phase detector of Dual Synthesizer, pin 18 (FINIF2). The internal phase detector is of the charged pump type.

The output of the phase detector is present at Dual Synthesizer pin 20 (DOIF). This signal is directed to loop filter R733, C738 and C739 and to tuning diode D730 of the tank circuit.

Transmit PLL

The TX VCO (Q463) is a discrete VCO that is controlled by the ESCORT IC U460. The VCO produces the TX frequency signals in the frequency band 806-870MHz. A discrete coil (resonator) Y460 and shunt capacitors are used as a tank circuit for VCO. The Colpitts Oscillator was adopted to ensure excellent performance in noise behavior and signal level stability throughout the whole band. Cascade amplifier is used as buffer to minimize the impact of load pull on the VCO frequency.

The synthesizer IC is the ESCORT IC employing NUD (near-unity-divider) technique to provide fast lock-in to TX frequency using a high reference frequency. The Main synthesizer is used as reference frequency source. The signal frequency of the Main VCO is divided by 36/32 (NUD) and compared with the TX VCO frequency in the fast phase comparator of the ESCORT. The comparator output signals IUP and IDOWN are then controlling the current mirror Q460 to supply the right tuning voltage to tuning diode D460 via loop filter R464, C472 and C473. ESCORT IC is controlled by RedCap2 via SPIA_CLK, SPIA_MOSI and SPIA_CS1_ESCORT.

Digital & Audio Section, Detailed Circuit Description

See Figure 4.2-9

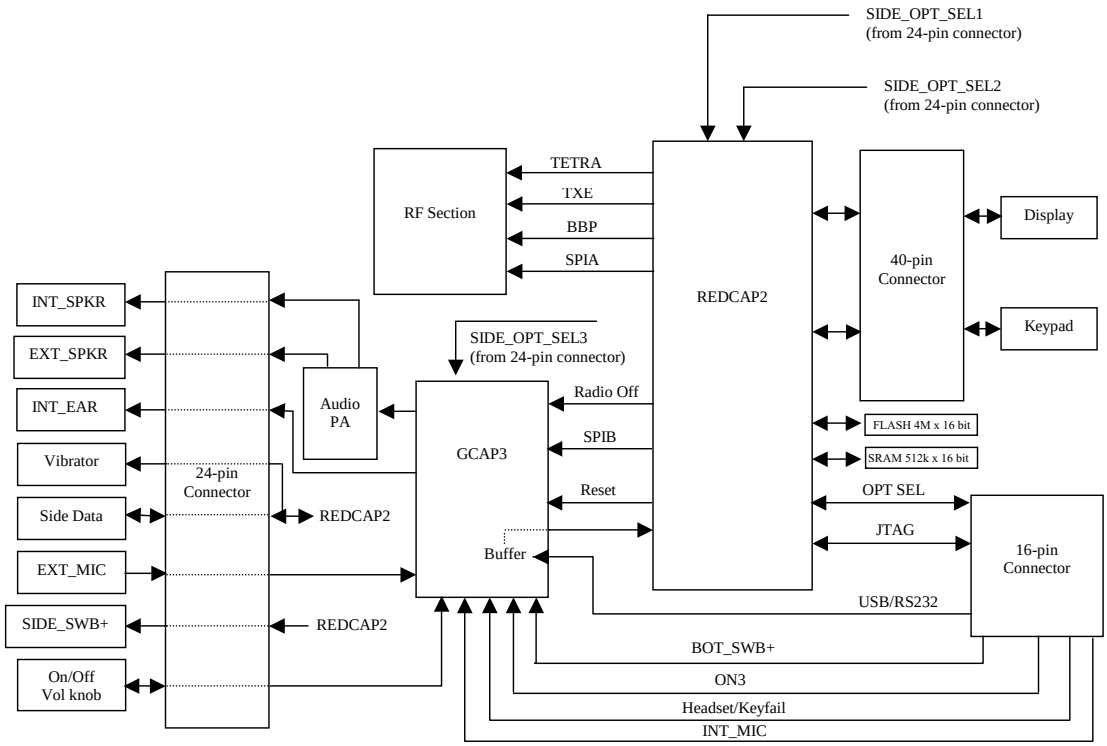

Figure 4.2-9 Digital Section - Detailed Circuit Diagram

RedCap2 (Microprocessor & DSP)

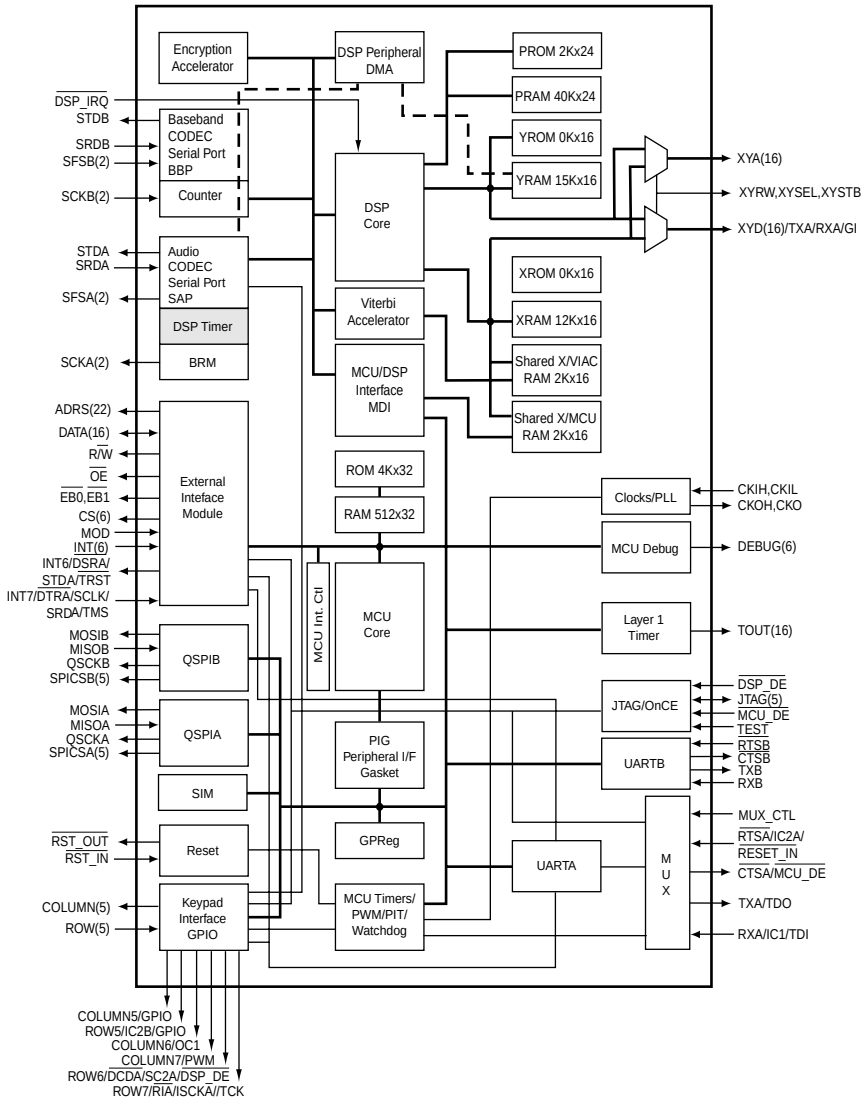

Figure 4.2-10 RedCap2 Block Diagram

Figure 4.2-10 is a block diagram of the RedCap2 and its interfaces.

The RedCap2 RISC processor controls the operation of the transmitter, receiver, synthesizer and audio (GCAP3) integrated circuits. It uses the Flash memory and SRAM, both located externally.

RedCap2 employs SPI protocol (Serial Peripheral Interface) to communicate with the RF ICs, display, keypad and other internal peripherals. The processor can be operated through the RS232 interface by a personal computer to program the Flash memory with firmware and codeplug.

Within the RedCap2 is the Digital Signal Processor (DSP) which performs modulation and de-modulation functions for the radio. It also performs ACELP speech coding and Forward Error Correction.

External Host Memories

The RedCap2 Address bus is a 22-bit wide (0:21) and RedCap2 Data Bus is a 16-bit wide (0:15).

RedCap2 uses two types of memories:

Flash Memory

The Flash memory is dedicated to the application software. This memory has a 16-bit wide data bus. The Flash memory is 4 Mega x 16-bit (ie 64 MBits density). When addressing the Flash memory location, the processor reads into its 16-bit wide data bus.

Apart from storing radio firmware, the Flash also stores the Radio CodePlug (Customer related information) such as telephone numbers, addresses, etc.

SRAM Memory

This 512k x 16-bit Static RAM is used for Data storage.

Serial Peripheral Interface (SPI)

The RedCap2 uses the SPI protocol (Serial Peripheral Interface) to communicate with RF IC's (WPIC, ODCT, ESCORT), GCAP3 IC and the display driver.

The protocol is built upon 4 lines [MOSI(Tx), MISO(Rx), CS, CLK)].

The RF IC's are connected to SPIA module, while GCAP3 and the display are connected via SPIB module.

The Display Module, based on the display driver (i.e. Samsung KS0741) uses a serial interface.

GCAP3

The Global Control Audio Power (GCAP3) IC handles DC power distribution and audio processing (ie audio amplification and analog-to-digital/digital-to-analog conversions). It contains switching and linear regulators, audio preamplifiers, 13-bit CODEC, 14-channel 10-bit A/D Converter, 8-bit D/A Converter and interfaces with an external Audio Amplifier for receive audio.

DC Power Distribution

See Figure 4.2-11

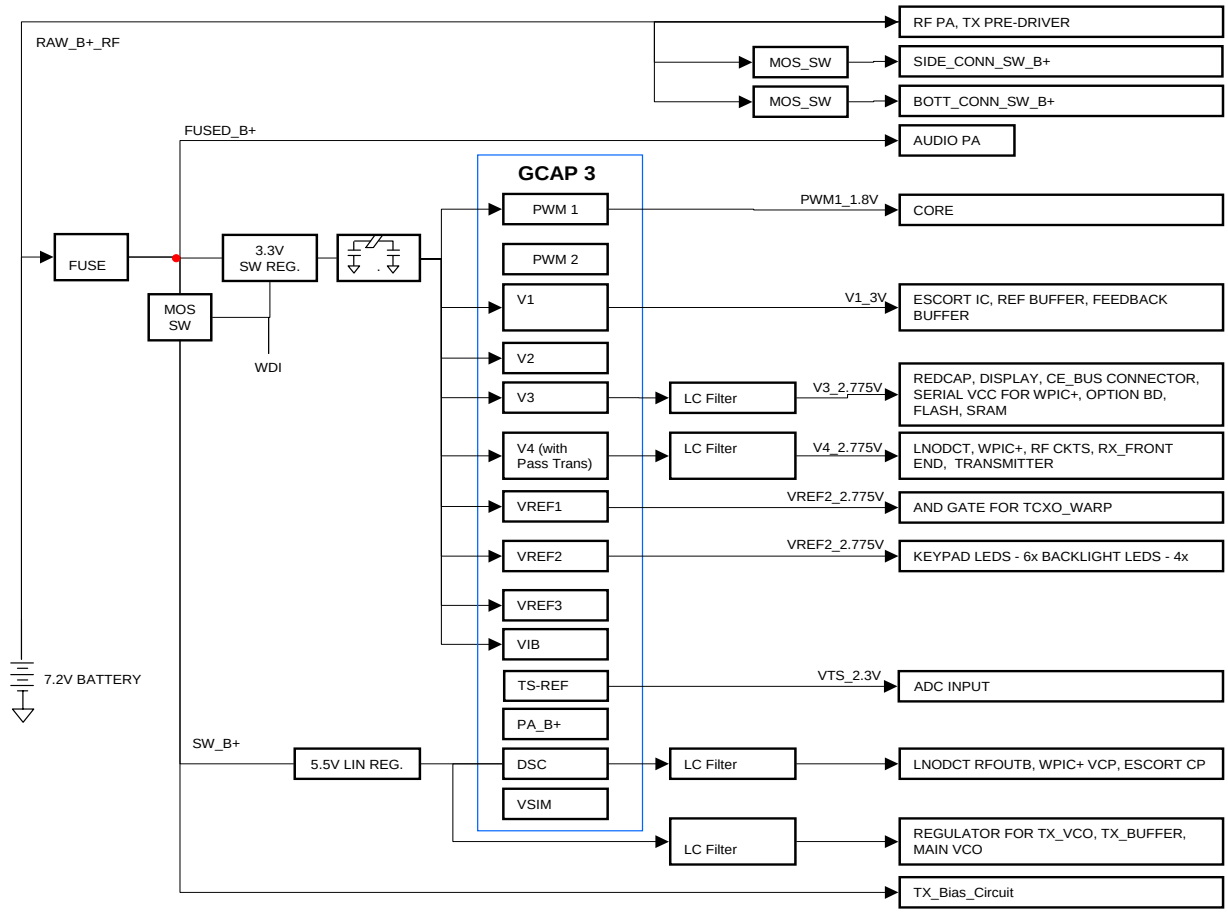

Figure 4.2-11 MTP700 DC Distribution

Several sections of the radio are connected directly to the battery, which supplies Raw_B+ and Fused_B+. The radio operates at a low voltage of 5.8Vdc, nominal-level voltage of 7.2Vdc, and high-level voltage of 12Vdc. The battery is connected to J001 pins 3 (+) and J001 pin 1 (-). These pins supply the Raw_B+ to the RF TX power amplifier. Raw_B+ is routed via F200 (Fuse) becoming Fused_B+, which is used by the Audio PA.

3.3V Switching Regulator

An external 3.3V switching regulator is used to convert the battery voltage (7.2V) down to 3.3V to be used by GCAP3. This regulator can be set to fixed freq 600KHz (during Tx & Rx) or variable switching frequency (when idle) depending on the load.

PWM #1 (Pulse Width Modulation)

PWM #1 is a selectable step down switching regulator. It is selectable using the RedCap2 SPIB bus from 1.2V to 2.45V in 6 steps, Pass Through and Power down modes. The switcher is active during Power Reset (POR) in 1.875V mode. It is set to 1.875V. Switching regulator is PWM #1_1.875V, which is the supply for the internal core, emulation port and clock output drivers of the RedCap2. The switcher is supplied from B+ and it is active whenever the radio is turned ON.

V1 Linear Regulator

V1 is a programmable linear regulator. It is programmed using the RedCap2 SPIB bus from 0.975V to 3.0V in 8 steps. This regulator is active during POR and its initial value is 1.55V. For this radio, V1 is programmed to 3.0V, supplying ESCORT section. This regulator is active whenever the radio is turned ON.

V2 Linear Regulator

V2 is a selectable linear regulator. It is selectable using the GCAP3 UV_SEL pin (internal logic) between either 2.5V and 2.775V. This regulator is active during POR and its initial output value is set by GCAP3 UV_SEL pin. Connecting UV_SEL pin to B+ sets V2 output value to 2.775V, connecting UV_SEL pin to Ground sets V2 output value to 2.5V. For this radio, V2 is selected to 2.775V. This regulator is supplied by B+ and it is active whenever the radio is turned ON. V2 is the supply for internal and external audio circuits, CLK_IN input driver and TS interface.

V3 Linear Regulator

V3 is a selectable linear regulator. It is selectable using the RedCap2 SPIB bus from 1.875V to 2.775V in 4 steps. This regulator is active during POR and its initial output value is 2.775V. For this radio, V3 is selected to 2.775V. The regulator is supplied by B+ and it is active whenever the radio is turned ON. V3 is V3_2.775V, which is the supply for the RedCap2, Flash, SRAM, GCAP3, Display, logic lines pull-up and 16-pin connector.

V4 Linear Regulator

V4 is a selectable linear regulator with external pass transistor. It is selectable using the RedCap2 SPIB bus from 1.875V to 2.775V in 4 steps. It is set to 2.775V. V4 is always powered from B+ and it is active whenever the radio is turned ON. This regulator is active during POR. V4 supplies all the RF sections.

VREF1 Linear Regulator

VREF1 is a programmable linear regulator. It is programmed using the RedCap2 SPIB bus from 0.95V to 2.775V. This regulator is active during POR and its initial value is 2.775V. For this radio, VREF1 is programmed to 2.775V and is battery supplied. VREF1 is VREF1_2.775V, which is the supply for the AND Gate on TCXO_WARP line.

VREF2 Linear Regulator

VREF2 is a programmable linear regulator. It is programmed using RedCap2 SPIB bus from 0.95V to 2.775V. For this radio, it is programmed to 2.775V which supplies the Tx/Rx LED, backlights and display.

TS_REF Linear Regulator

TS_REF is a fixed output linear regulator. It is supplied internally from the V2 linear regulator. It is set to 2.3V. The radio uses TS_REF for the AD voltage dividers. It is not active at POR.

5.5V Linear Regulator

This is an external linear regulator used to supply GCAP3 DSC regulator, and a 4.5V linear regulator in ESCORT section. Its supplies comes from SWB+.

DSC Linear Regulator

DSC is a fixed output linear regulator. This regulator is active during POR in the 5V mode. DSC is supplied from an external 5.5V linear regulator. DSC 5V is used to supply the WPIC and ODCT charge pump circuits. It is also used by ESCORT and Main VCO sections.

Current Limit

The SWB+ current limit regulator provides power from the phone battery to clip-on accessories. It is enabled only when the phone is powered up and an accessory which requires power from the phone is connected.

Radio Audio System

See Figure 4.2-12

The audio system consists of the GCAP3 IC (U200) and the DSP (U301), both are located on the main board.

The GCAP3 perform the analog task and part of the digital task of the audio system.

Tx Path

Audio speech is fed either to the internal microphone or the external microphone. The signals reach the GCAP3 IC. In the GCAP3 IC, a fix gain amplifier (A3 or A5) provides the signal amplification, the multiplexer (MUX) selects the active input and the Programmable Gain Amplifier (TxPGA) adjust the path gain according to the radio mode of operation. Finally, the A/D converts the analog signal into digital format and transfers it to the DSP. The DSP performs the functions of audio filtering, ACELP speech compression, forward error correction (FEC), digital modulation, and transfers the data to the RF section. When the radio is operating in the telephone interconnect mode, the DSP performs the required tasks such as echo and noise reduction.

Rx Path

The digital output signal from the receiver is fed to the DSP which performs the functions of digital de-modulation, FEC, ACELP speech de-compression, and audio filtering. It transfers the data to the GCAP3 IC. In this IC, the D/A converts the digital audio format to an analog signal, the Programmable Gain Amplifier (RxPGA) adjusts the path gain according to the setting of the volume control, and the multiplexer routes the audio to the active receive path. The audio is fed to A4, single-ended audio power amplifier. It is then fed to the Audio PA, where most of the amplification is performed and can be selected either to go through the internal speaker or external speaker. Altenatively, the audio from GCAP3 can also be sent through A1 to the internal Earpiece.

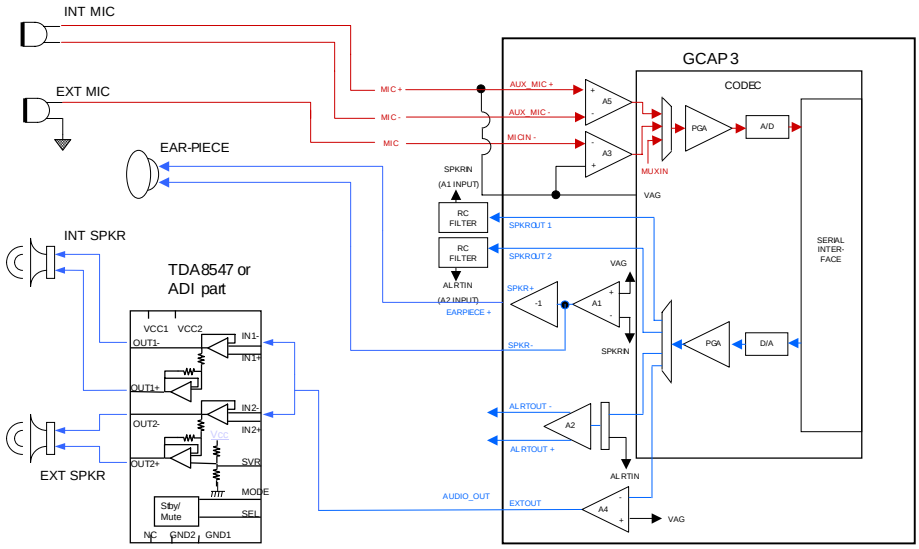

Figure 4.2-12 Audio Path - Block Diagram

RS232, SB9600, JTAG

The RedCap2 processor (RCE) uses the three serial protocols: RS232/UART, SB9600, and JTAG to communicate with external devices via the bottom connector of the unit. There is no external hardware for switching from one protocol to another because the RedCap2 handles the switching and line multiplexing functions internally.

Battery ID

The battery is equipped with a Dallas 2502 EPROM. A one-wire serial bus allows the radio or the battery charger to communicate with the battery and identify whether or not the battery is compatible. If the battery is determined to be incompatible, the unit automatically shuts off, and the charger does not enter charging mode.

Besides compatibility data, the EPROM also stores the following information: battery type, capacity, fuel-gauging parameters, and voltage threshold.

Display and Keypad, Detailed Description

Display

The LCD (Liquid Crystal Display) Module is a Graphic Display based upon the KS0741TB-01 display driver.

It consist of LCD Holographic Glass, LED backlight and a 22 pin flex cable connected to the Keypad board.

The Communication to the RedCap2 IC is performed using a SPI protocol (Serial Peripheral Interface). The Operation of the LCD is determined upon the RS line configuration (Data/Command).

The Display is 128 X 100 (Columns X Rows respectively).

Keypad

The RedCap2 processor (RCE) is responsible for decoding key presses and displaying them properly on the LCD. The keys are arranged into a matrix of five rows and five columns, which includes the Volume and PTT keys.

The PWR key is not decoded by the RCE; it directly drives the GCAP3, which sends a signal to RCE through INT1. The five row lines are pulled high via five internal 22 Kohm resistors. The five row lines and five column lines are fed to RedCap2 I/O pins. Pressing any key also generates the keypad internal interrupt. The RedCap2 debounces the keys by reading them 25 milliseconds later.

The keypad-decoding scheme works as follows:

1. RedCap2 sets rows to inputs; all columns are set as outputs and driven logic low.
2. Rows are pulled logic high. When a key is pressed, one row goes low, which indicates a key press and sends an internal interrupt.
3. RedCap2 reads rows. A low on that row indicates a key press. All others are high.
4. RedCap2 sets all columns to output logic high.
5. One column at a time is set to output logic low. RedCap2 reads the columns to see which one is now at a logic low level.
6. The low row level (in step 3) and low column level (in step 5) indicate the correct column and row.

All keypad circuitry is located on the keypad board. Refer to the keypad board schematics.

Backlight and LEDs

Backlight

The keypad backlight consists of 8 green LEDs. There are 2 more LEDs in the LCD module that are connected in parallel to the keypad LEDs.

Top LEDs

There is a tri-color (Green, Red and Amber when both turns on) LED located on the main board. These LED colors are used as indicators to the radio operation.

Radio Programming

The radio is entered into programming mode by setting the MOD pin high level, and applying a preamble sequence to the radio via the RS232 lines. A 12Vdc can be applied to pin 15 on the 16-pin connector to set the radio into flashing mode.

The MOD pin assertion is encountered at least 4 CKIH cycles before the negation of the Reset pin.

Accessory Connector

The radio provides two connectors for access to personal computers, data devices and audio accessories.

Bottom Connector

The 14-pin bottom connector is intended to support connection to personal computers, and test systems. The bus has seven standard modes of operation: Normal (Nothing Connected), USB Mode, Emergency, PTT, RS232 Mode 4-wire, RS232 8-wire/SSI Mode and SB9600 mode. There are also three additional non-standard modes, KEYLOAD, FLASH, and JTAG, which are used only for secure keyloading, development, factory programming and debugging.

These modes are selected by applying appropriate logic levels to the Option Select pins, named OPTION1 and OPTION2. Some of the modes listed above are selected by the additional application of a level on the USB POWER and CE_ON_OFF pins as well.

Mode Select (OPTION1 and OPTION2)

Logic levels applied to the OPTION1, OPTION2, USB POWER, and ON_OFF/JTAG/FLASH lines are used to select the different modes. The modes will be set as follows:

Table 4.2-1 Bottom Connector Mode Table

	MODE	ON_OFF/ JTAG/ FLASH	BOTTOM OPTION1	BOTTOM OPTION2	USB PWR
Standard Modes	Normal (No Accessory)	0	1	1	0
	USB Accessory / Computer	0	1	1	>4.0V
	Emergency	0	1	0	X
	RS-232 (4 wire) / SSI	0	*		X
	PTT (Push To Talk)	0	0	0	X
	RS-232 (8 wire)	0	0	1	X
	SB9600	0	*		X
Non Standard Modes	KEYLOAD	0	----		X
	FLASH	11.4-12.6 V	X	X	X
	JTAG	7.6-8.4 V	X	X	X

Note: * Schottky Diode with forward voltage less than 0.4V.

Logic Levels

1 : 2.0V to 2.85V, typical 2.775V
0 : 0V to 0.8V
X : Do Not Care Condition

Pin No.	Signal Name (Short_Form)	Power/ Default States	USB	RS232/ SSI	RS232 (8 wire)	SB9600	JTAG
1	Power Ground (GND)	GND	GND	GND	GND	GND	GND
2	USB+/TXD (D+)/TDO		D+	TXD	TXD	TXD	TDO
3	USB-/RXD (D-)/TDI		D-	RXD	RXD	RXD	TDI
4	USB Power/RTS/Reset_In		USB_ PWR	RTS	RTS	BUSY IN	RESET_IN
5	SWB+	SWB+	SWB+	SWB+	SWB+	SWB+	SWB+
6	CTS/MCU_DE			CTS	CTS	BUSY OUT	MCU_DE
7	FS/DCD/DSP_DE			FS	DCD		DSP_DE
8	SCK/RI/TCK			SCK	RI		TCK
9	SRDA/DTR/TMS			SRDA	DTR		TMS
10	STDA/DSR/TRST			STDA	DSR		TRST
11	Bottom_Option_1 (BOT_OPT1)	BOT_ OPT1	BOT_ OPT1	BOT_ OPT1	BOT_ OPT1	BOT_ OPT1	BOT_ OPT1
12	Bottom_Option_2 (BOT_OPT2)	BOT_ OPT2	BOT_ OPT2	BOT_ OPT2	BOT_ OPT2	BOT_ OPT2	BOT_ OPT2
13	On_Off/JTAG/FLASH Mode (On_Off/JTAG)	On_Off /JTAG	On_Off /JTAG	On_Off /JTAG	On_Off /JTAG	On_Off /JTAG	On_Off /JTAG
14	Headset Indication/Key_Fail	Key	Key	HS/Key	Key	Key	

Table 4.2-2 Bottom Connector Pin Out Table

Side Connector

The side connector is intended to support connection to accessories such as PSM, RSM, Headset, 2 or 4-wire data terminals and SB9600 based devices.

The side connector has 16 modes of operation as shown in Table 4.2-3.

In order to be compatible with previous generation radios, the modes of operation are selected by applying the appropriate logic levels to the Side Option Select Pins named SIDE_OPTION1, SIDE_OPTION2. In addition, SIDE_OPTION3 will be used to select the other modes as per Table 4.2-3. Voltage level for SIDE_OPTION3 is per Table 4.2-4.

Table 4.2-3 Side Connector Mode Table

	Mode	SIDE OPTION1	SIDE OPTION2	SIDE OPTION3
1	Ext PTT	0	0	V4
2	Emergency	0	0	V3
3	Volume Up	0	0	V2
4	Volume Down	0	0	V1
5	Man Down	0	0	V0
6	MAP27	1	0	V4
7	Spare	1	0	V3
8	SB9600/SBEP	1	0	V2
9	4-Wire Data (RS232)	1	0	V1
10	2-Wire Data (RS232)	1	0	V0
11	Ext Spkr	0	1	V4
12	RSM with earbud	0	1	V3
13	RSM/PSM	0	1	V2
14	User Programmable 2	0	1	V1
15	User Programmable1	0	1	V0
16	Idle	1	1	V4

Symbol	Min Level/V	Typical/V	Max Level/V
V0	0	0.3	0.58
V1	0.62	0.8	0.98
V2	1.02	1.2	1.38
V3	1.42	1.6	1.78
V4	1.82	2.1	2.30

Table 4.2-4 Voltage Levels for Side Option3

Pin No.	Signal Name
1	Ext_Speaker+
2	Ext_Speaker-
3	OPT B+
4	Ext_Mic
5	SIDE_OPT2
6	SIDE_OPT1
7	GND
8	Rx_Data
9	Tx_Data
10	CTS / BUSY_OUT
11	RTS / BUSY_IN
12	SIDE_OPT3
13	VIBRATOR

Table 4.2-5 Side Connector Pin Out Table

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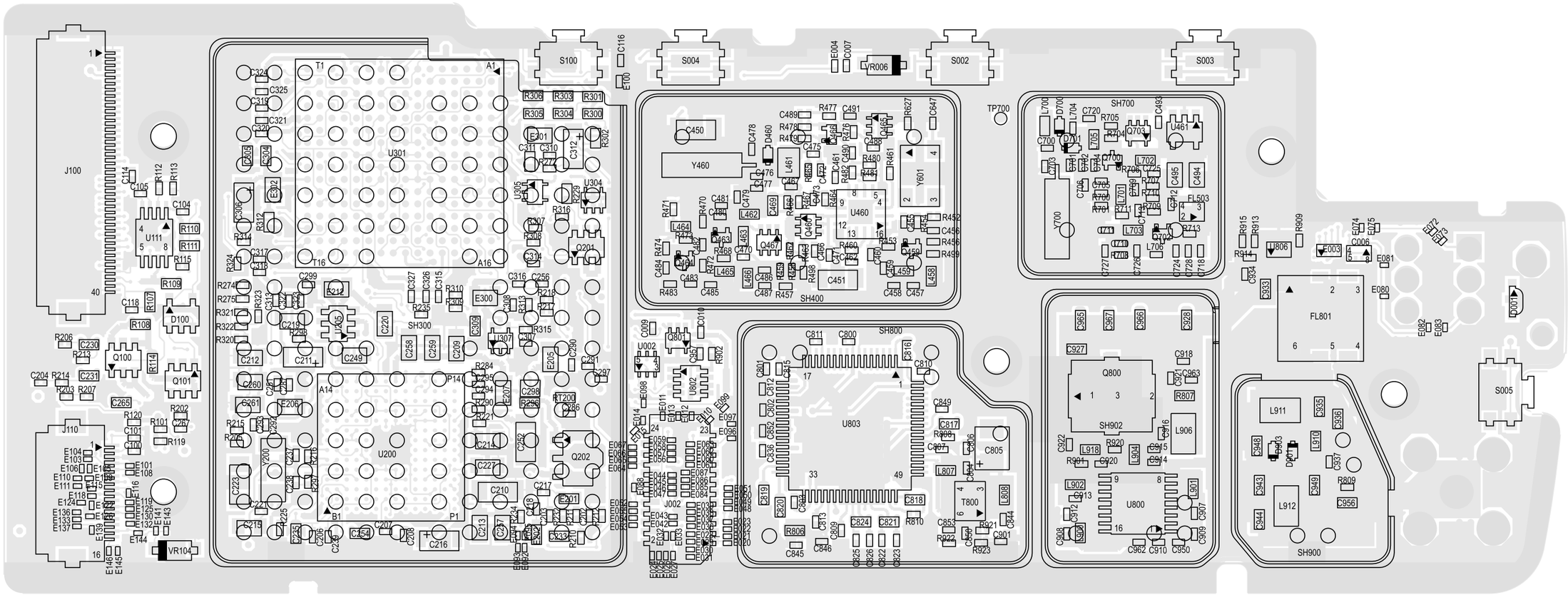
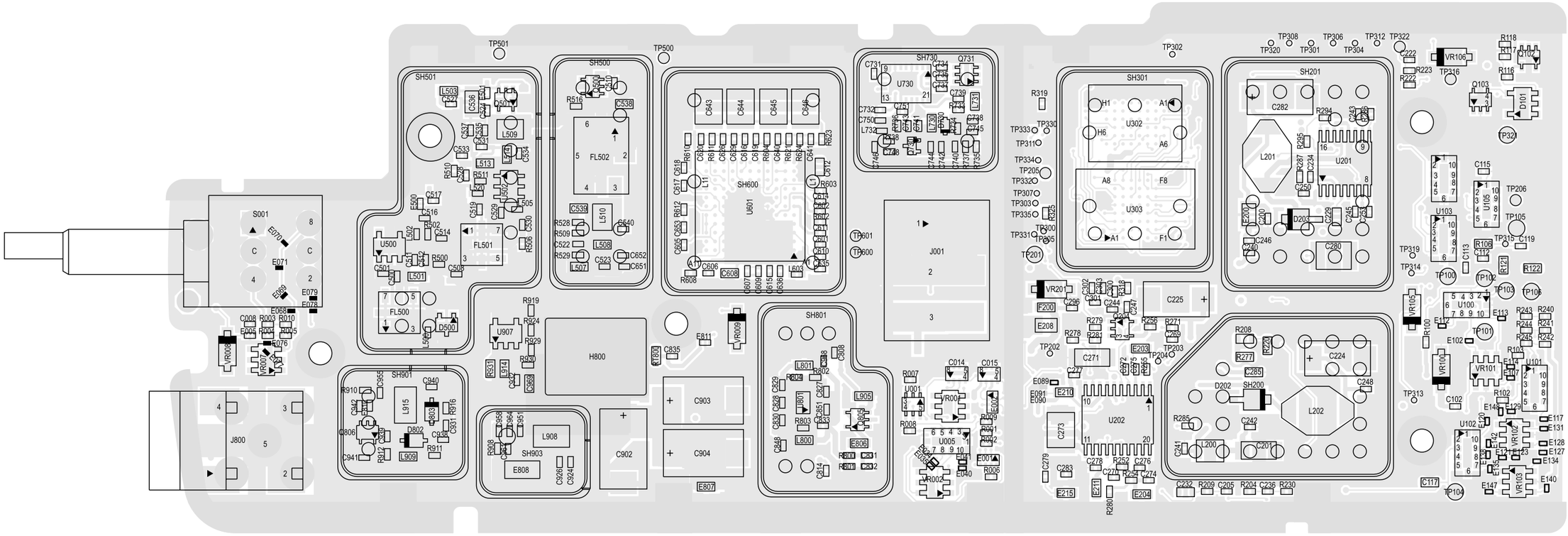
806-870 MHz Board Layout, Schematics & Parts Lists



ZMY0130995-A

806-870 MHz Main Board Top Side PCB No. 8485951Z04


TP501
TP500
TP302
SH501
SH500
SH730
SH301
SH201
SH600
SH801
SH901
SH903
SH200
S001
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H800
U730
U302
U303
U201
U202
U600
U601
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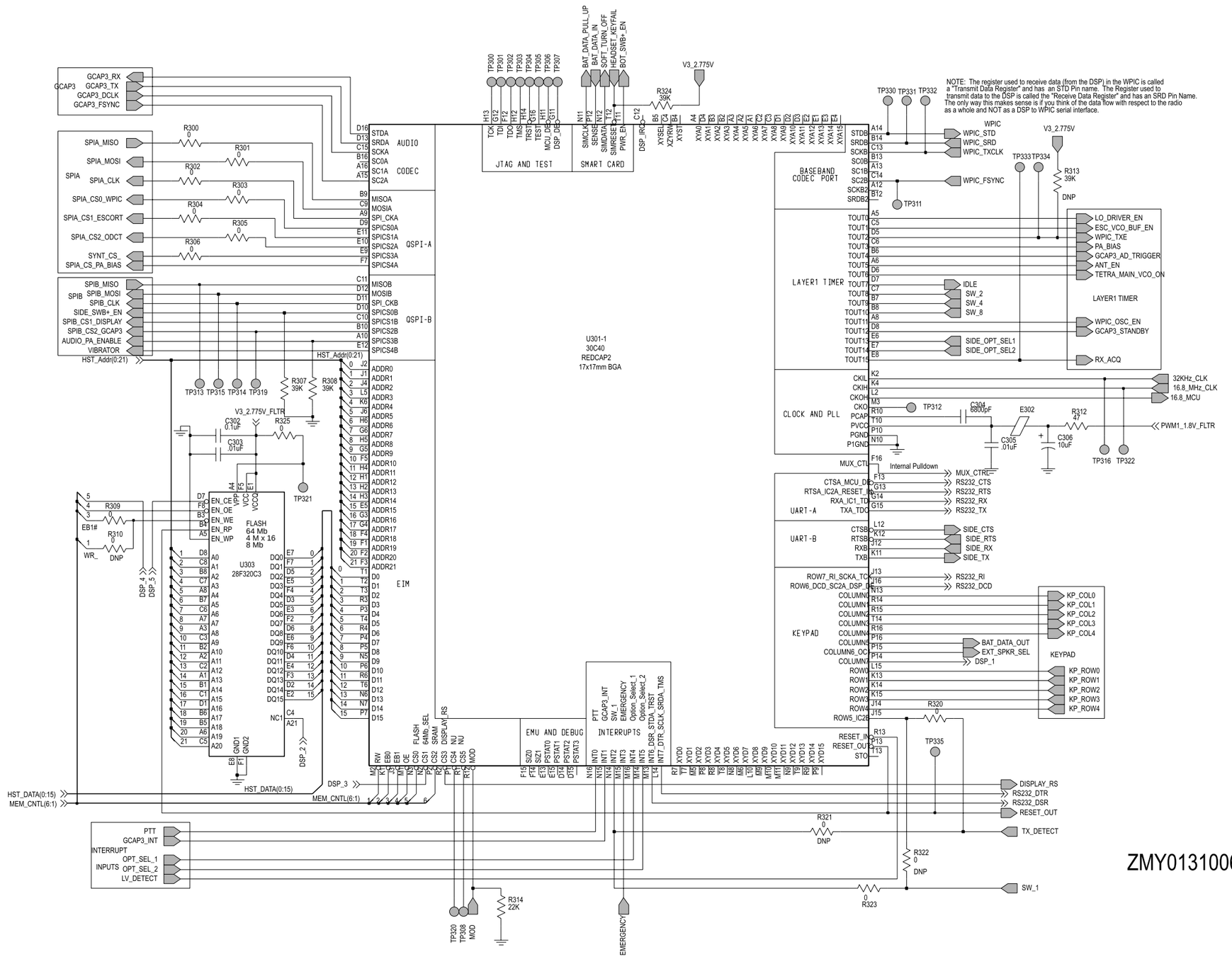
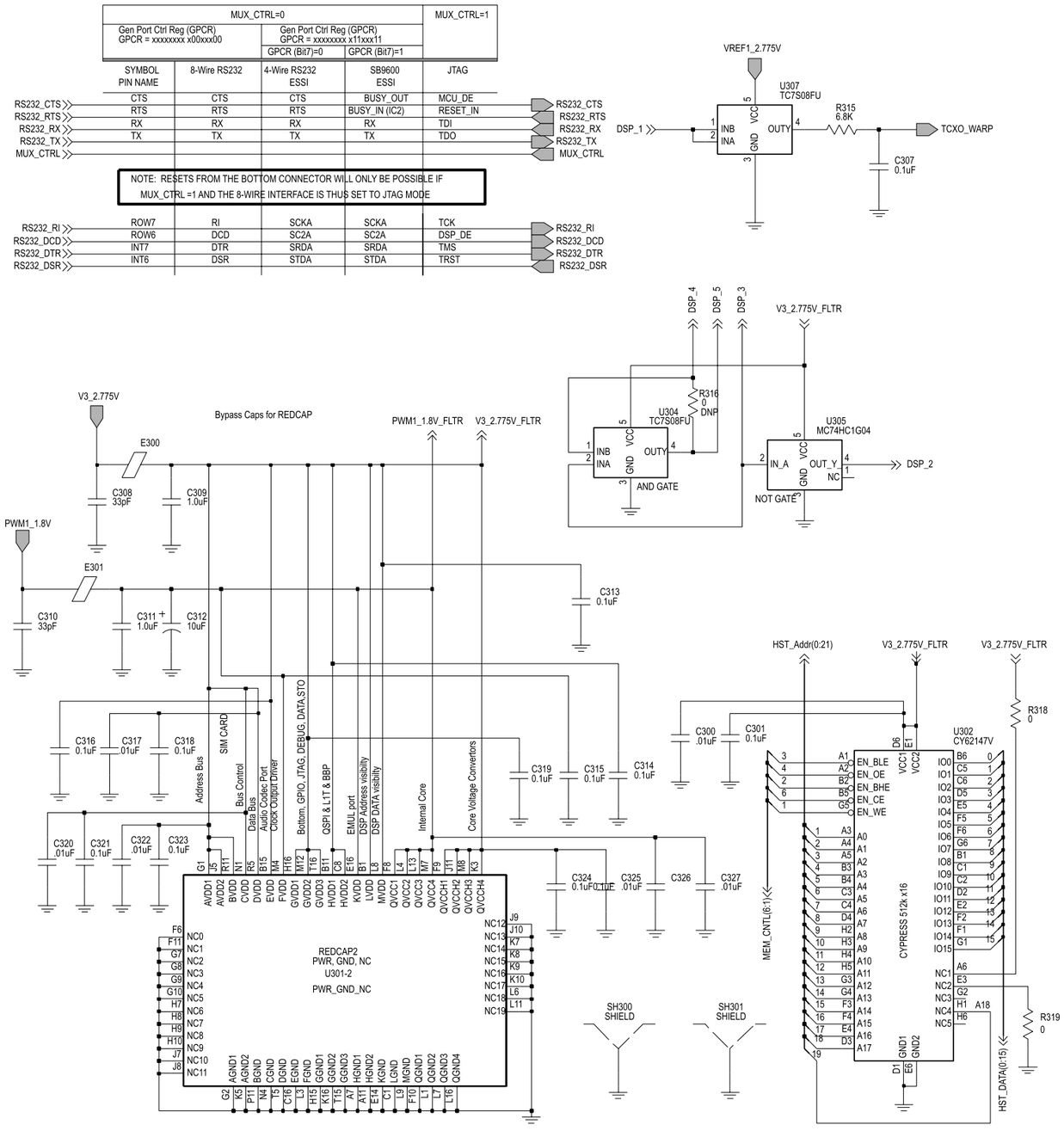


ZMY0131006-O

Controller Memory Schematic Diagram (Redcap 2) sheet 1 of 2



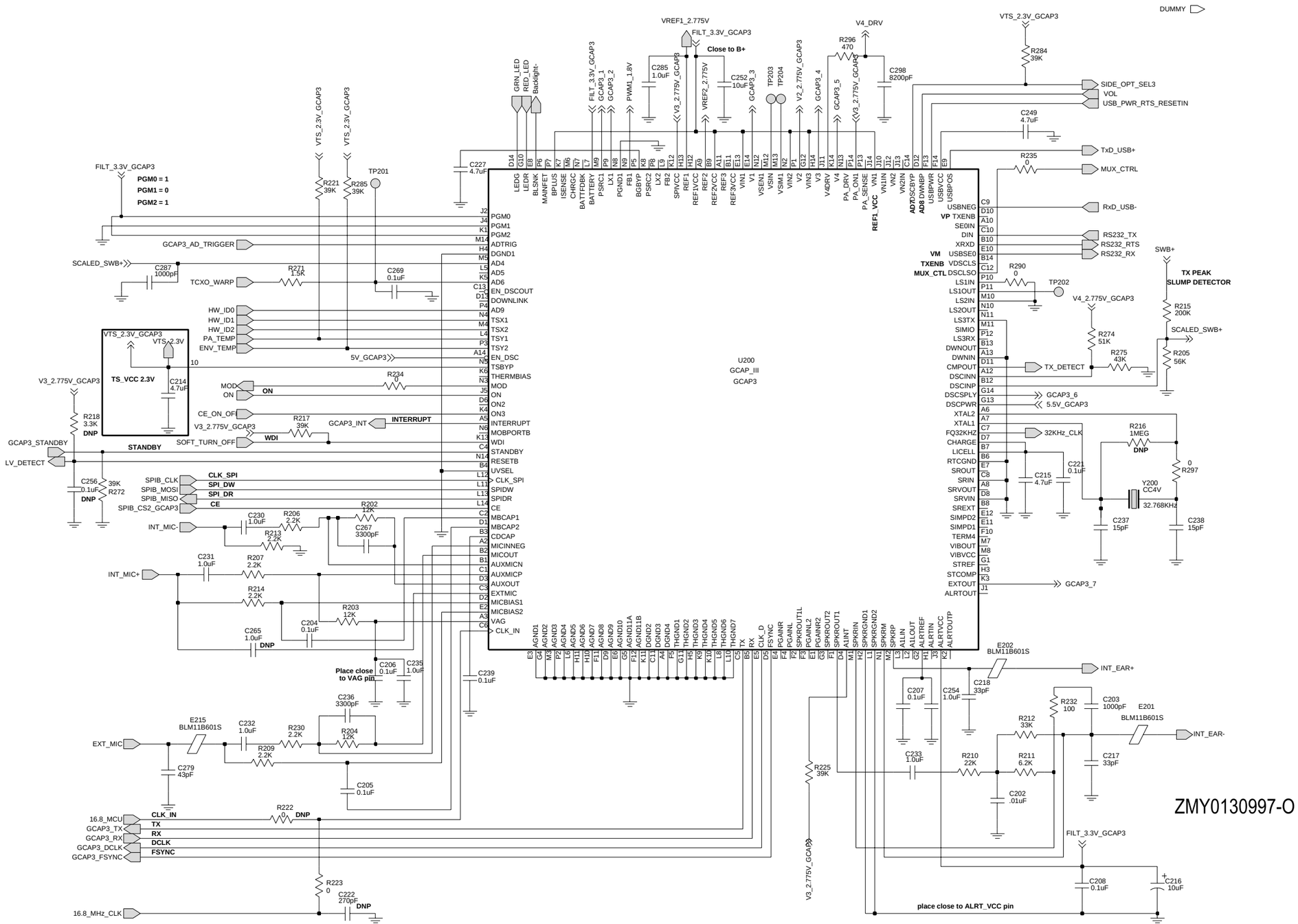
DNP (Do Not Place) List
R310
R317

LARGEST REF DES. NUMBERS	
C328	E302
R325	D300
U306	TP321

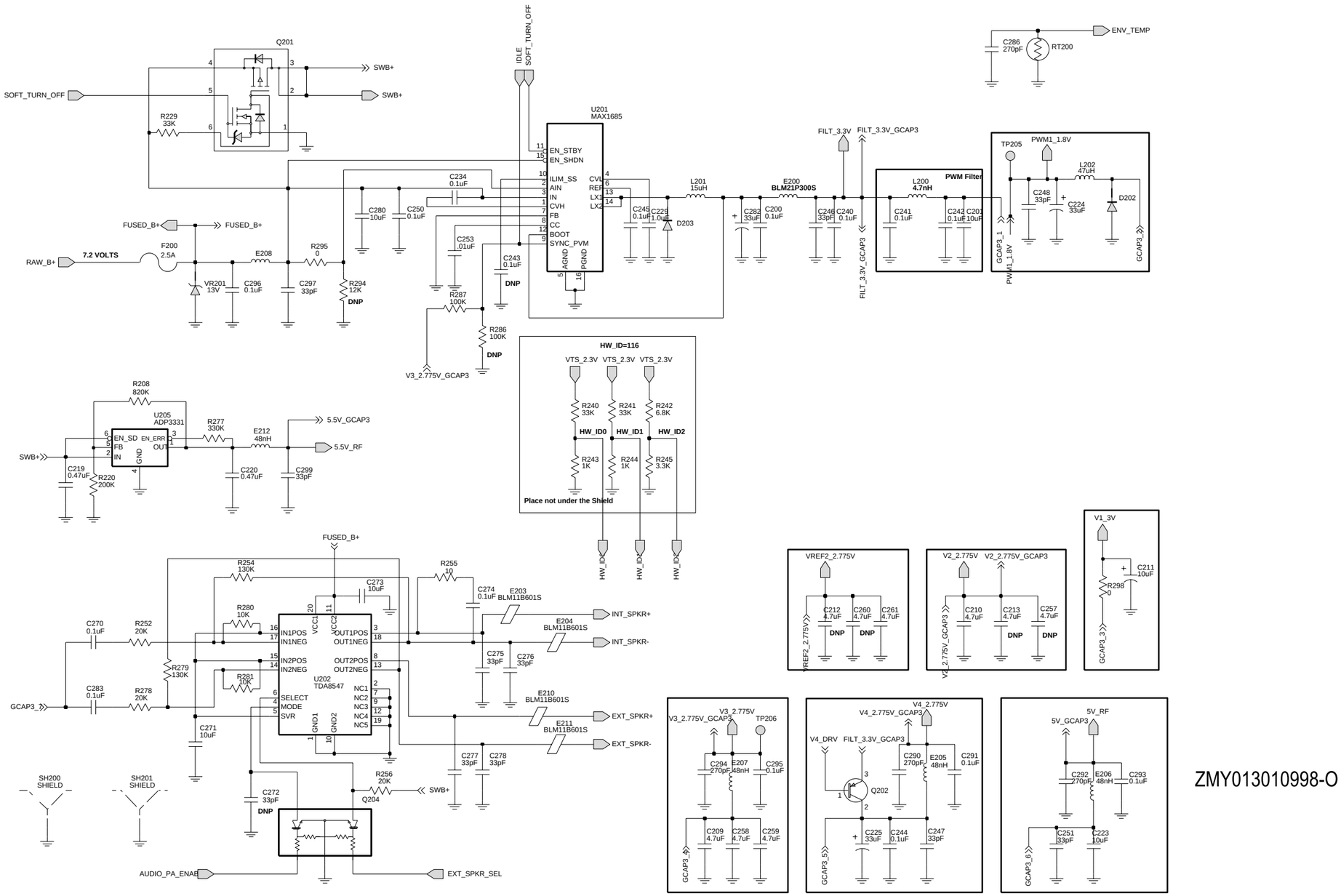
VCC TRUTH TABLE
V3_2.775V = 2.775V (from GCAP3 V3)
PWM2_1.8V = 1.875V (Redcap Core, ADDR/Data Bus, Flash, SRAM.
VSIM1 = 3V for the SIM and QVCCH

ZMY0131007-O

Controller Memory Schematic Diagram (Redcap 2) sheet 2 of 2

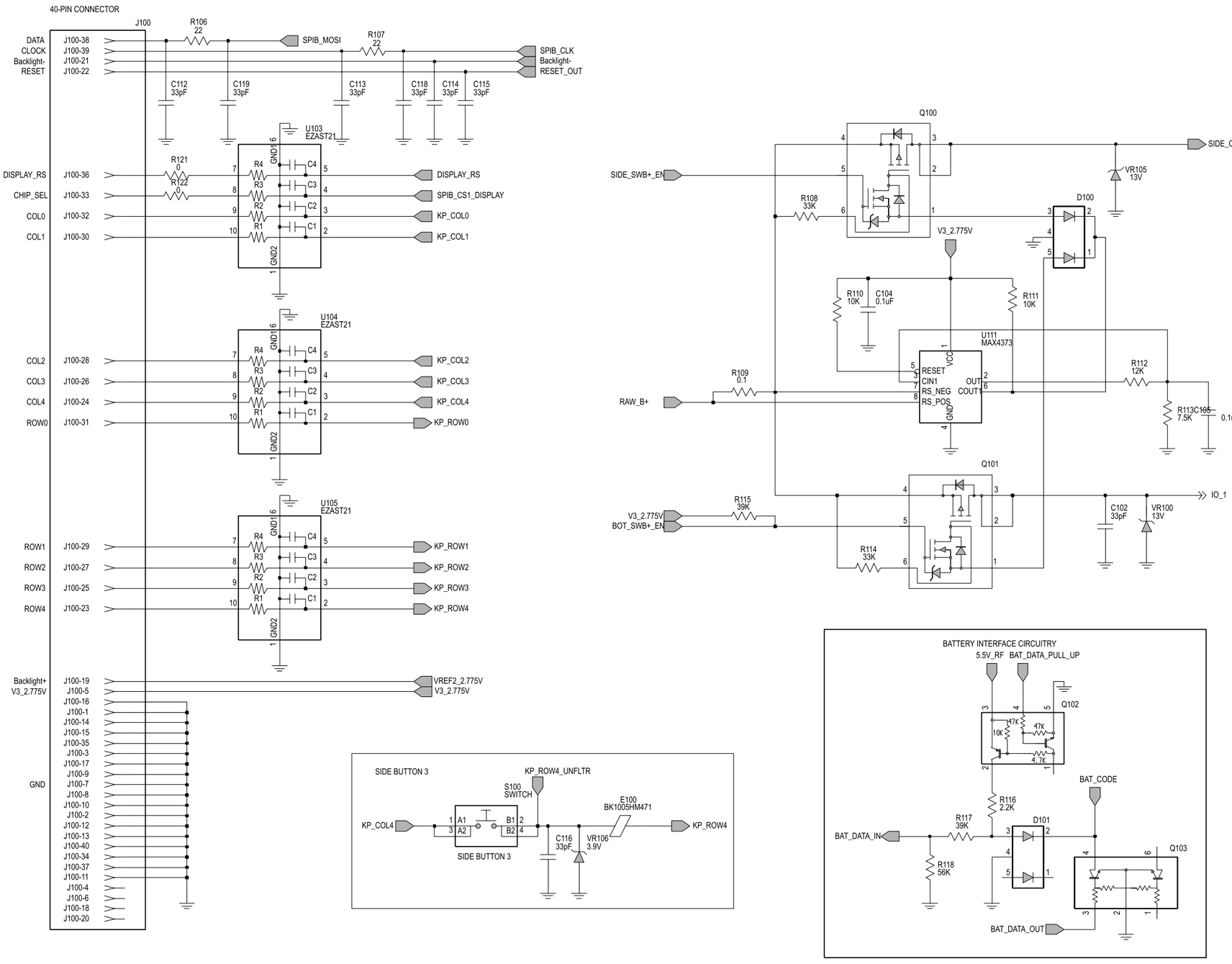


DC Supply & Audio Schematic Diagram (GCAP 3) sheet 1 of 2



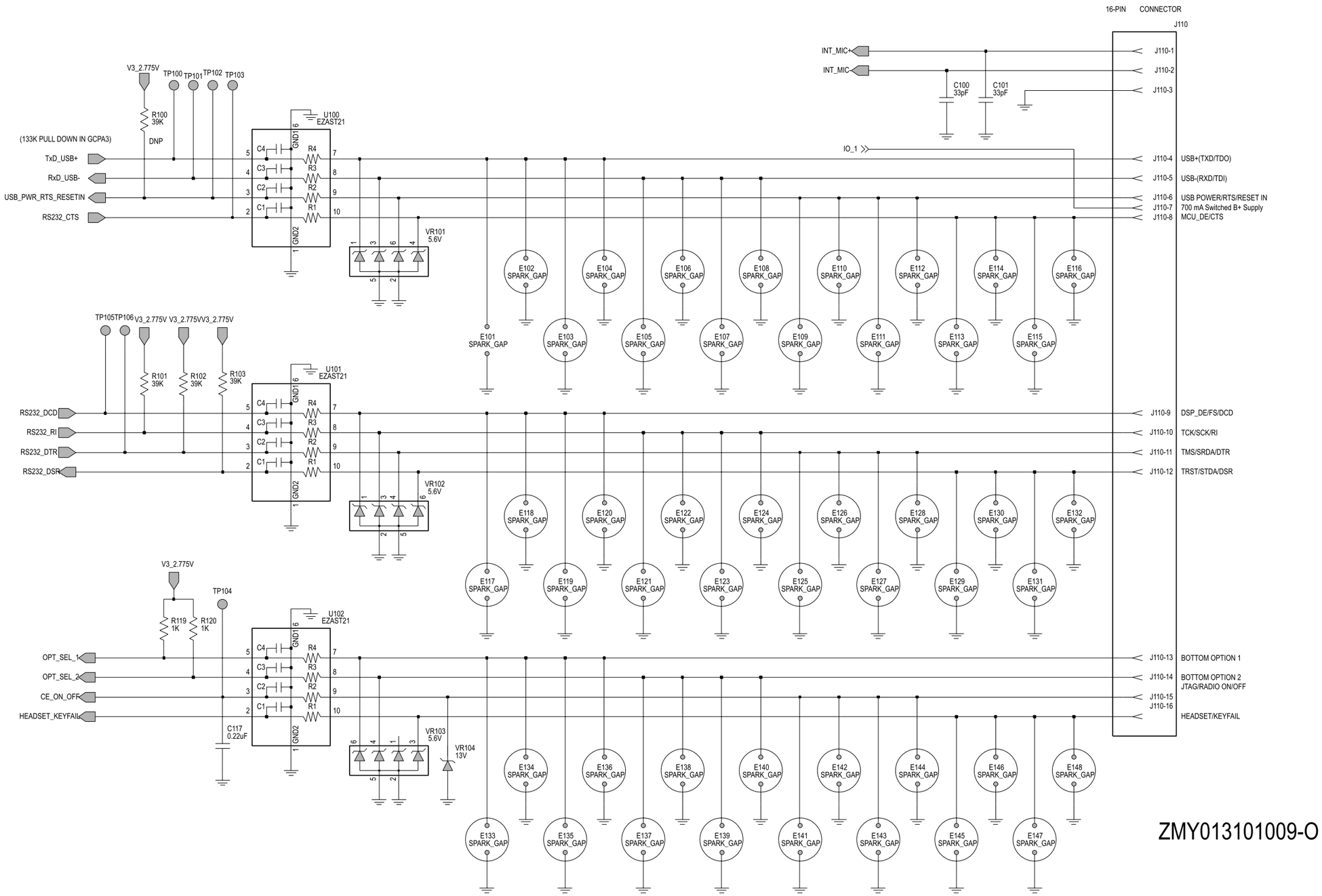
ZMY013010998-O

DC Supply & Audio Schematic Diagram (GCAP 3) sheet 2 of 2



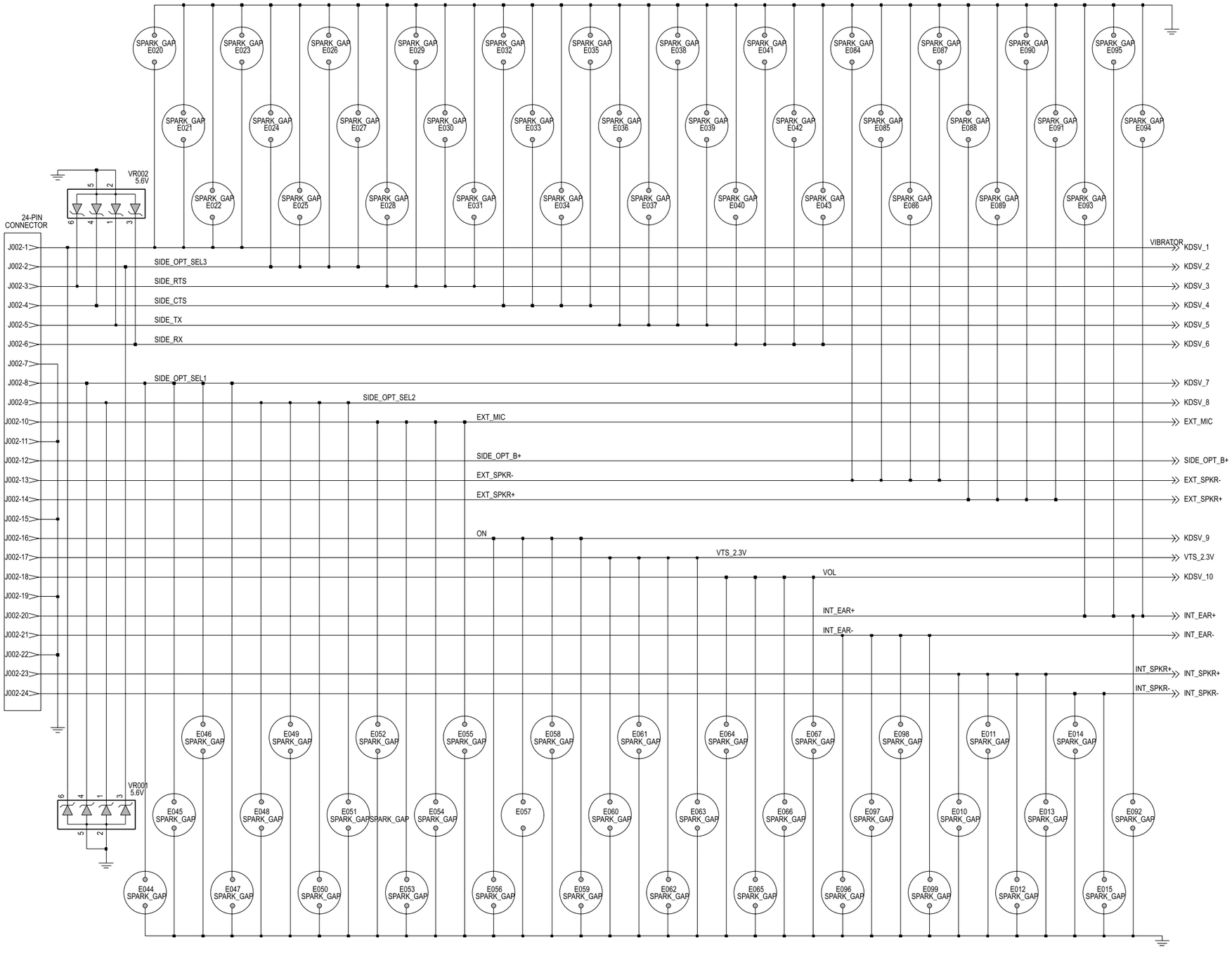
ZMY0131008-O

I/O Interface Schematic Diagram sheet 1 of 2



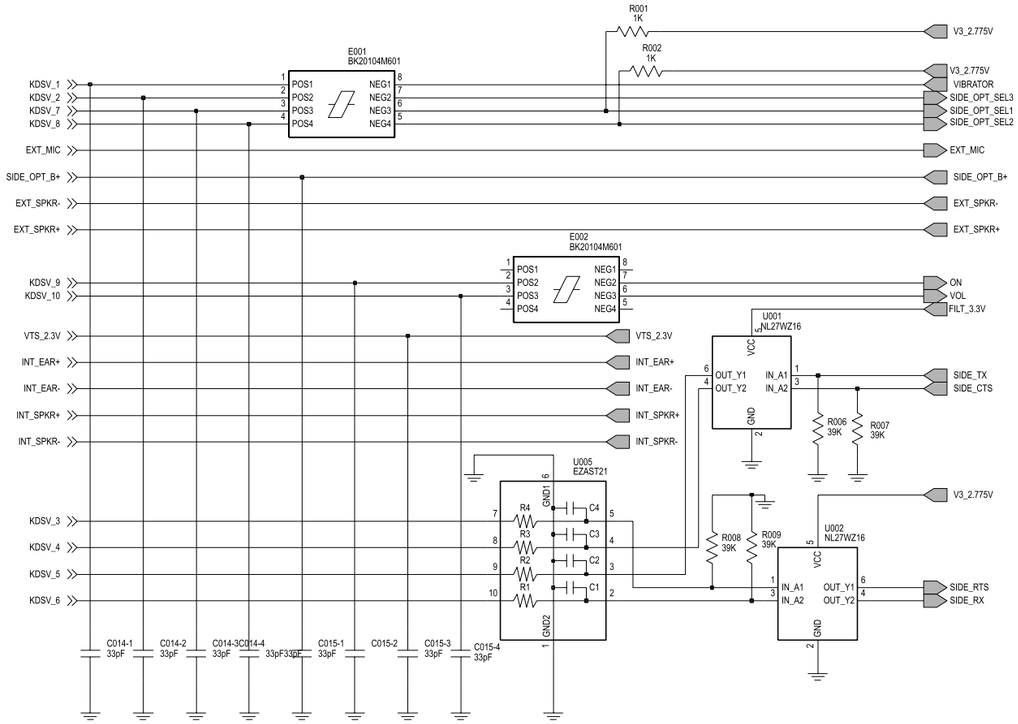
ZMY013101009-O

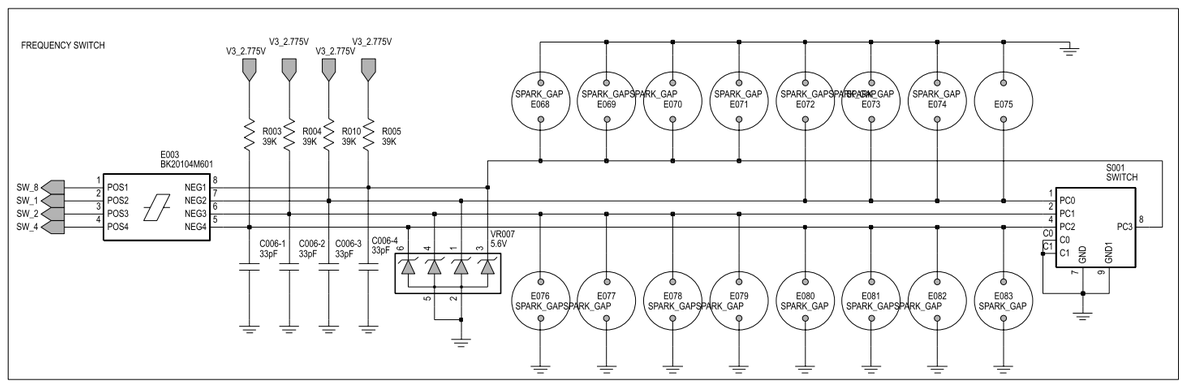
I/O Interface Schematic Diagram (sheet 2 of 2)

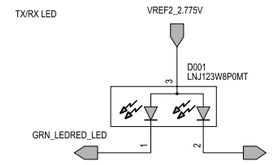


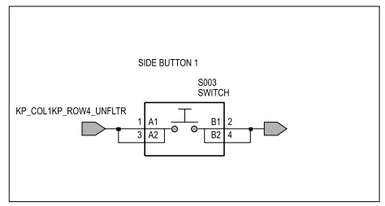
ZMY0131014-O

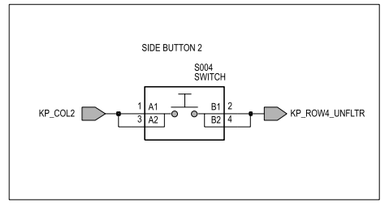
Switches And Associated Components Schematic Diagram (sheet 1 of 2)

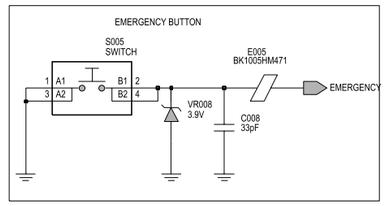


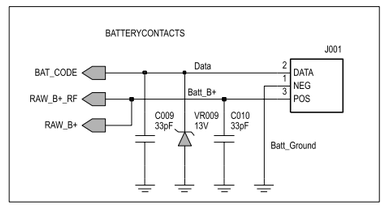


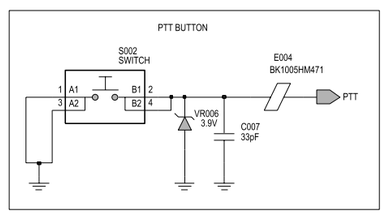






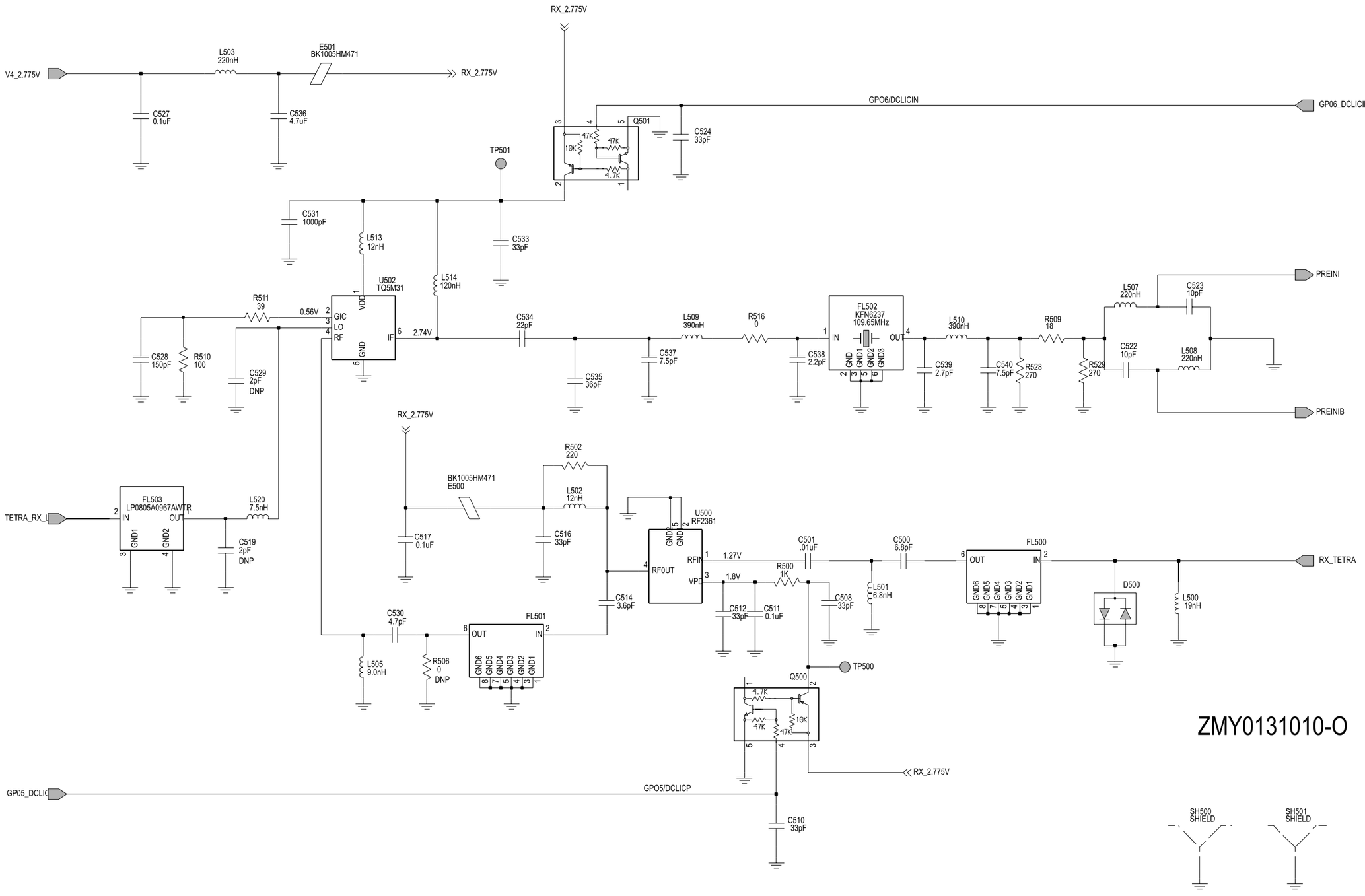






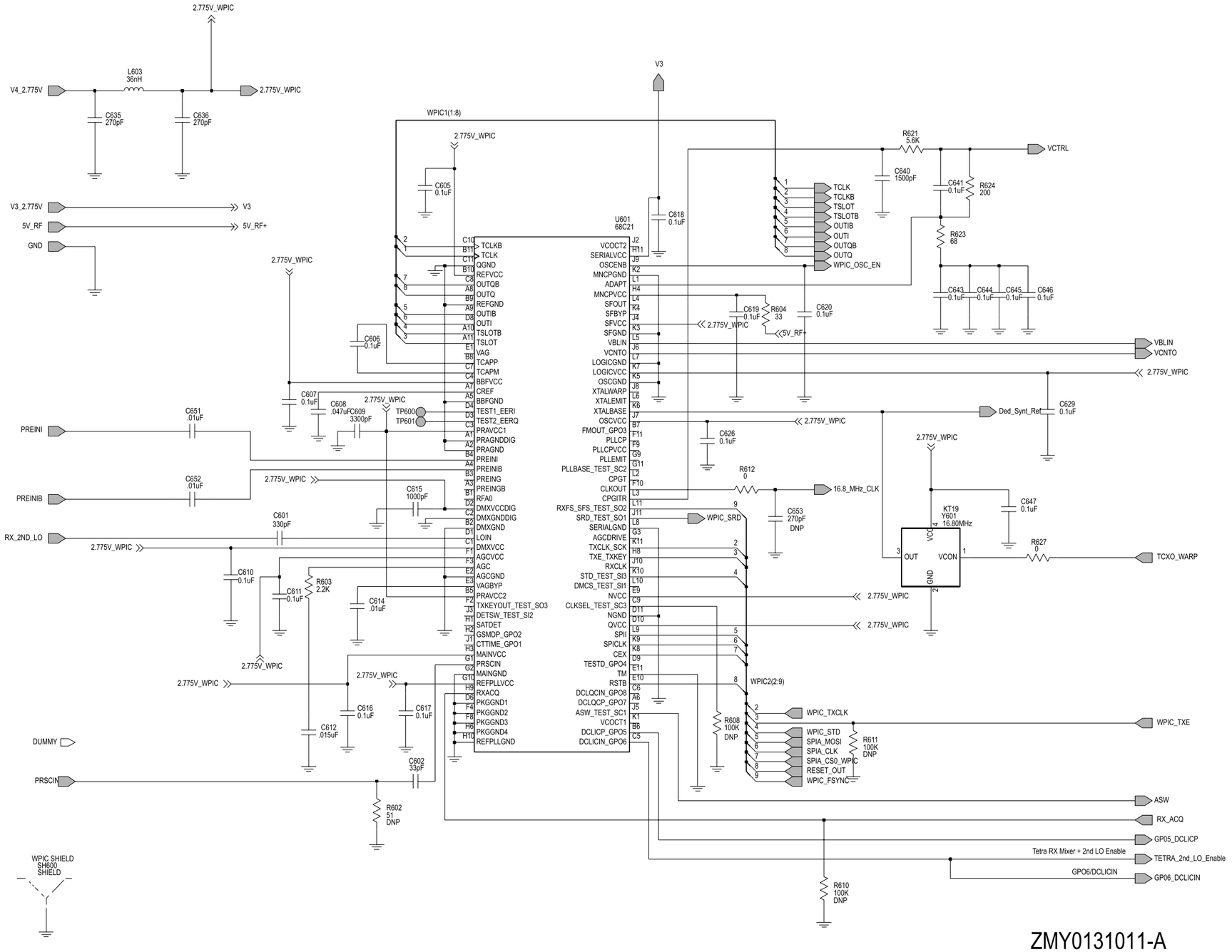
ZMY0131015-O

Switches And Associated Components
Schematic Diagram (sheet 2 of 2)



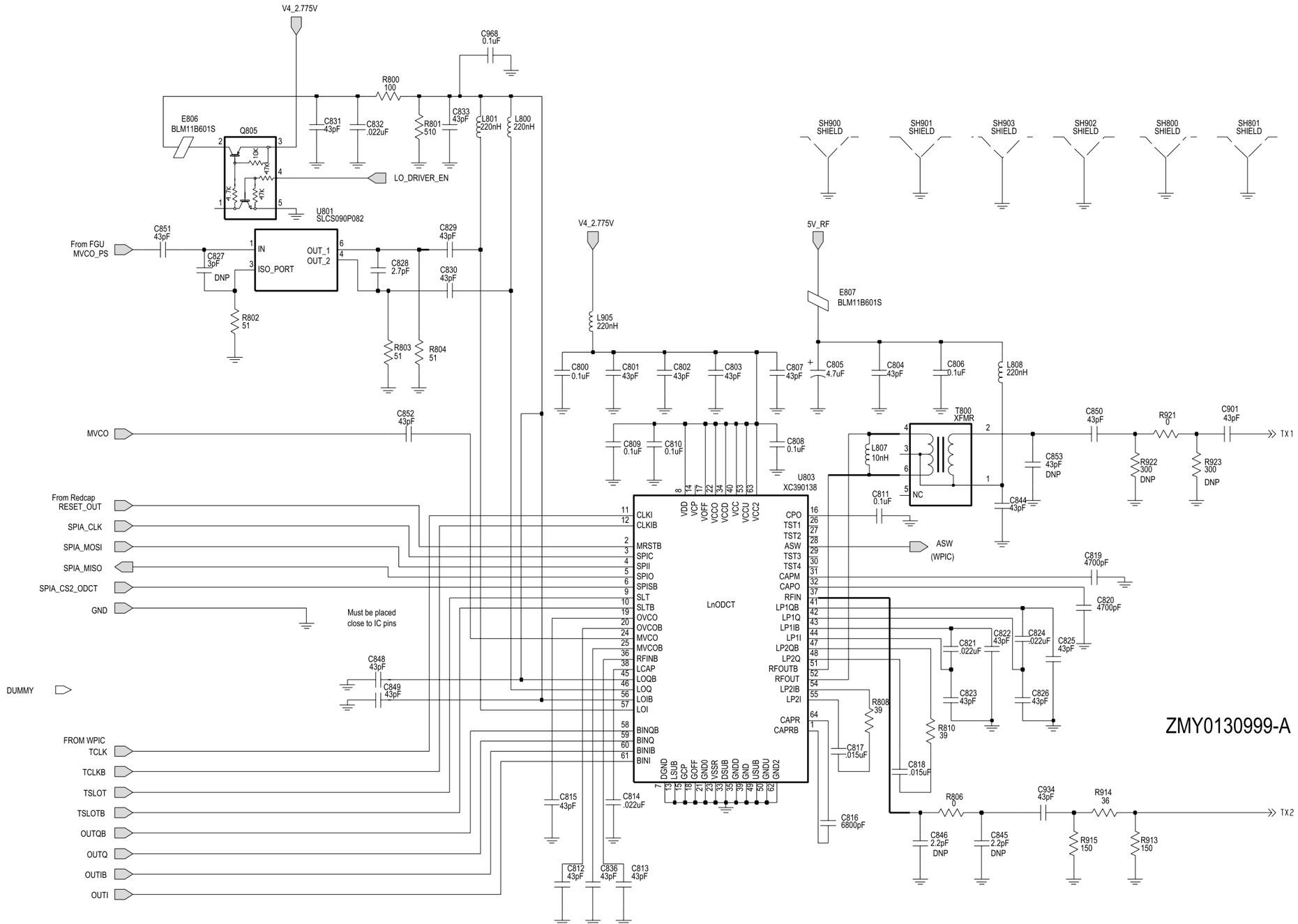
ZMY0131010-O

Receiver Front End Schematic Diagram



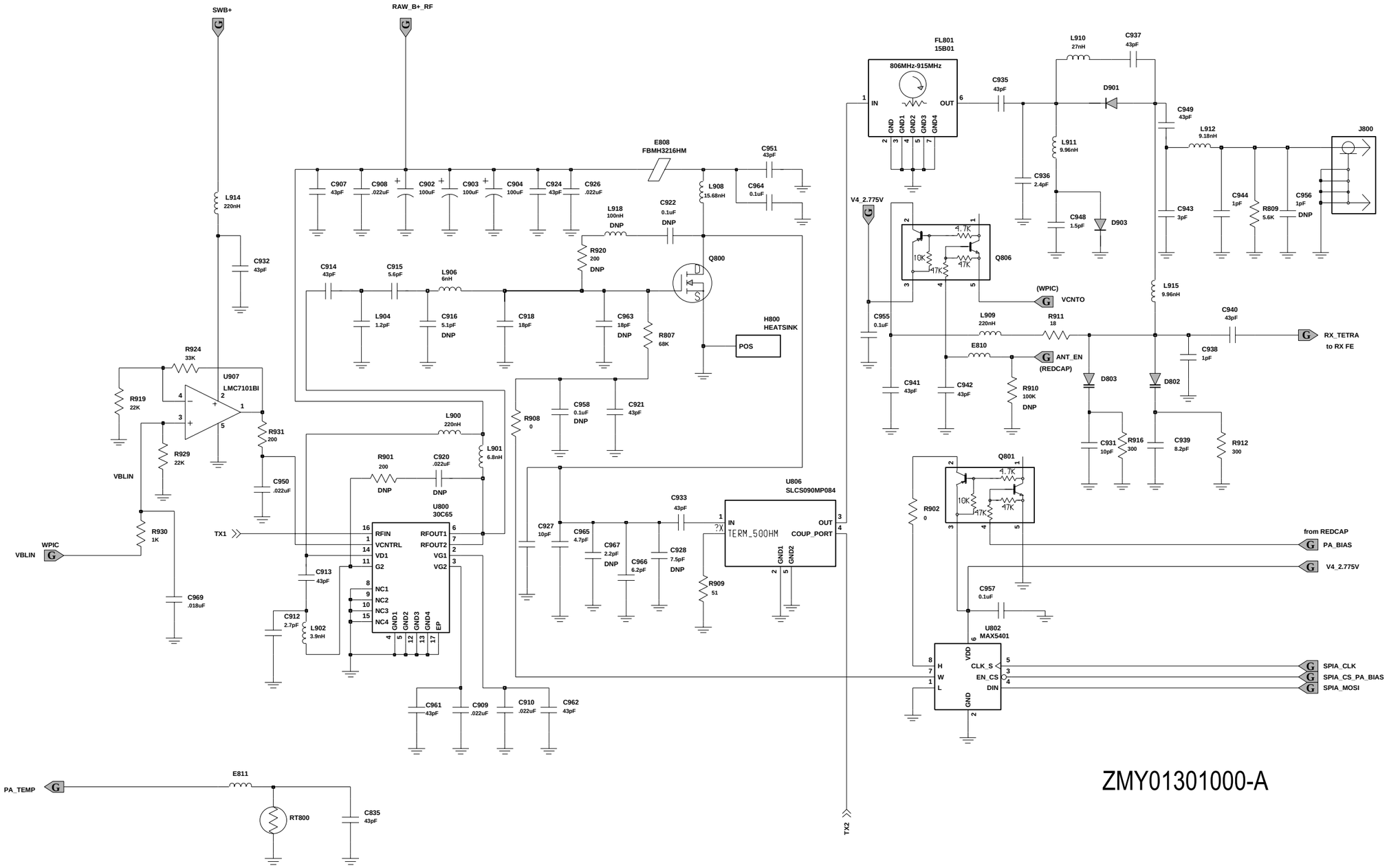
ZMY0131011-A

Receiver Back End Schematic Diagram



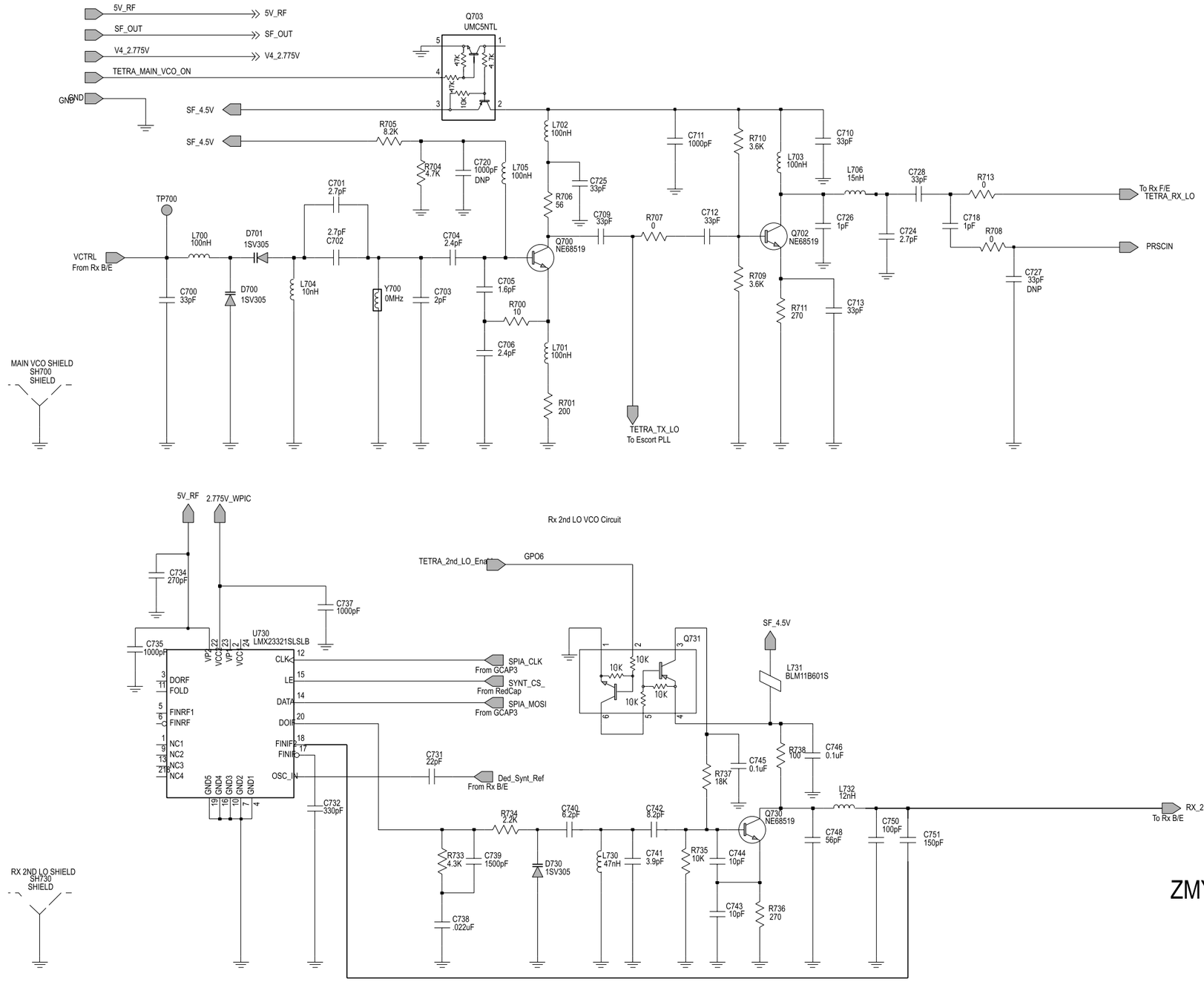
ZMY0130999-A

Transmitter Schematic Diagram (sheet 1 of 2)



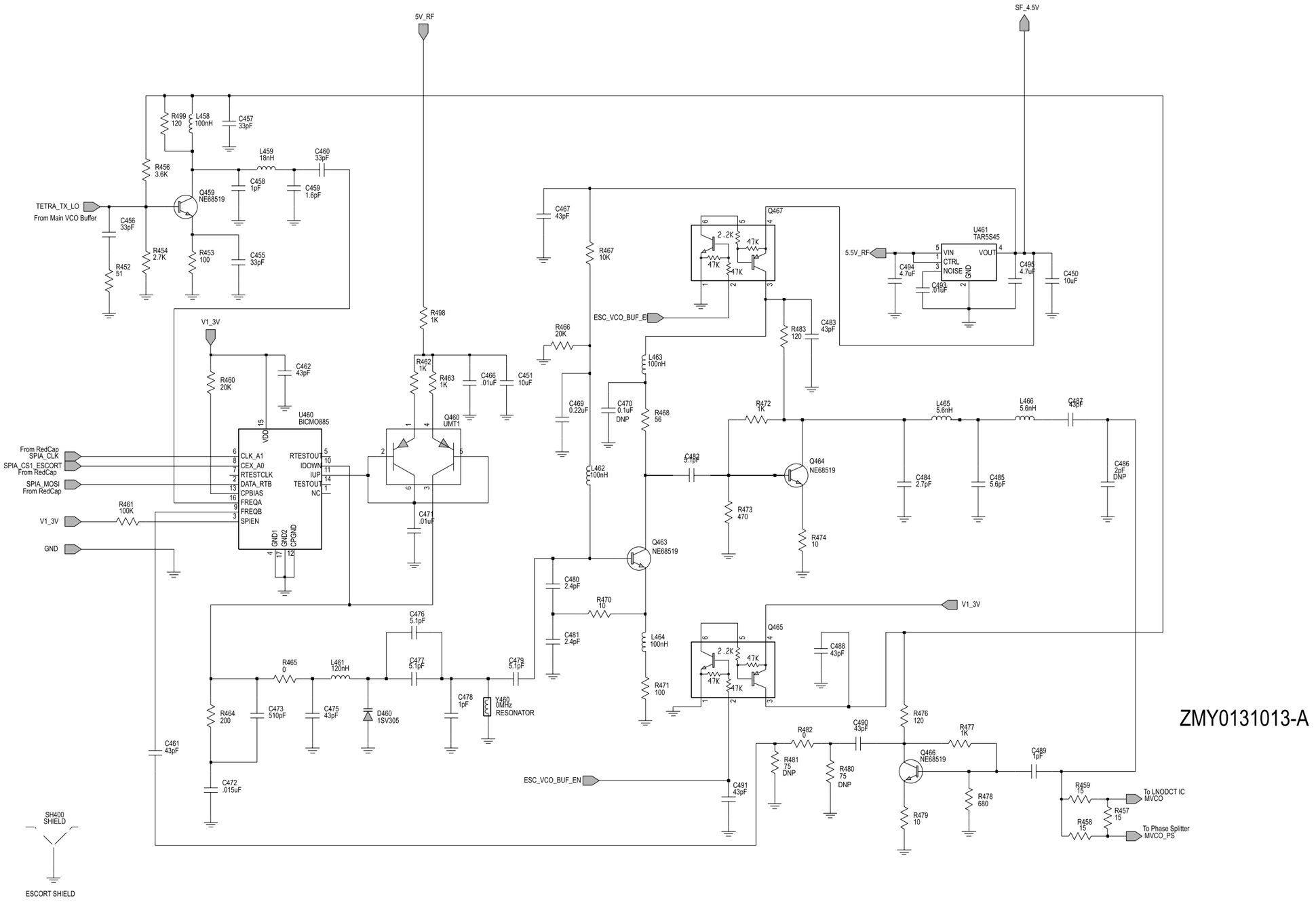
ZMY01301000-A

Transmitter Schematic Diagram (sheet 2 of 2)



ZMY0131012-O

Frequency Generation Unit Schematic Diagram



ZMY0131013-A

ESCORT Schematic Diagram

806-870 MHz Radio Parts List

Circuit Ref	Motorola Part No.	Description
C006	2186133Z01	Capacitor Array 33PF +/-10% 0805
C007	2113743N38	Cap Chip 33.0 PF 5% COG
C008	2113743N38	Cap Chip 33.0 PF 5% COG
C009	2113743N38	Cap Chip 33.0 PF 5% COG
C010	2113743N38	Cap Chip 33.0 PF 5% COG
C014	2186133Z01	Capacitor Array 33PF +/-10% 0805
C015	2186133Z01	Capacitor Array 33PF +/-10% 0805
C100	2113743N38	Cap Chip 33.0 PF 5% COG
C101	2113743N38	Cap Chip 33.0 PF 5% COG
C102	2113743N38	Cap Chip 33.0 PF 5% COG
C104	2113743M24	Cap Chip 100000 PF +80-20% Y5V
C105	2113743M24	Cap Chip 100000 PF +80-20% Y5V
C112	2113743N33	Cap Chip 20.0 PF 5% COG
C113	2113743N33	Cap Chip 20.0 PF 5% COG
C114	2113743N38	Cap Chip 33.0 PF 5% COG
C115	2113743N38	Cap Chip 33.0 PF 5% COG
C116	2113743N38	Cap Chip 33.0 PF 5% COG
C117	2113743K16	Cap Chip .220 UF +80-20% 16V
C118	2113743N44	Cap Chip 56.0 PF 5% COG
C119	2113743N44	Cap Chip 56.0 PF 5% COG
C200	2113743M24	Cap Chip 100000 PF +80-20% Y5V
C201	2113928K09	Cap Cer Chip 10.0 UF 6.3V 10%
C202	2113743L41	Cap Chip 10000 PF 10% X7R
C203	2113743L17	Cap Chip 1000 PF 10% X7R
C204	2113928N01	Cap Cer Chip 0.1UF 10% 6.3
C205	2113928N01	Cap Cer Chip 0.1UF 10% 6.3
C206	2113928N01	Cap Cer Chip 0.1UF 10% 6.3
C207	2113928N01	Cap Cer Chip 0.1UF 10% 6.3
C208	2113743M24	Cap Chip 100000 PF +80-20% Y5V
C209	2113928C04	Cap Cer Chip 4.7UF 6.3V10%0805
C210	2185802B01	Cap 10V 4.7UF
C211	2311049A72	Cap Tant Chip 10.0UF 10% 10V
C212	Not Placed	GCAM Dummy Part Number
C213	Not Placed	GCAM Dummy Part Number
C214	2113928C04	Cap Cer Chip 4.7UF 6.3V10%0805
C215	2113928C04	Cap Cer Chip 4.7UF 6.3V10%0805
C216	2311049A72	Cap Tant Chip 10.0UF 10% 10V
C217	2113743N38	Cap Chip 33.0 PF 5% COG
C218	2113743N38	Cap Chip 33.0 PF 5% COG
C219	2113743A27	Cap Chip .470 UF 10% 16V
C220	2113743A27	Cap Chip .470 UF 10% 16V
C221	2113928N01	Cap Cer Chip 0.1UF 10% 6.3
C222	Not Placed	GCAM Dummy Part Number
C223	2113928K09	Cap Cer Chip 10.0 UF 6.3V 10%
C224	2311049C15	Cap Tant Chip 33.0 UF 10V 10%
C225	2311049A97	Cap Tant Chip 33 UF 16V 20%
C227	2113928C04	Cap Cer Chip 4.7UF 6.3V10%0805
C229	2113928A01	Cap Cer Chip 1.0 UF1 0V
C230	2113928A01	Cap Cer Chip 1.0 UF1 0V
C231	2113928A01	Cap Cer Chip 1.0 UF1 0V
C232	2113928A01	Cap Cer Chip 1.0 UF1 0V
C233	2113928A01	Cap Cer Chip 1.0 UF1 0V
C234	2113743M24	Cap Chip 100000 PF +80-20% Y5V
C235	2113928A01	Cap Cer Chip 1.0 UF1 0V
C236	2113743L17	Cap Chip 1000 PF 10% X7R
C237	2113743N30	Cap Chip 15.0 PF 5% COG
C238	2113743N30	Cap Chip 15.0 PF 5% COG
C239	2113743M24	Cap Chip 100000 PF +80-20% Y5V
C240	2113743M24	Cap Chip 100000 PF +80-20% Y5V
C241	2113743M24	Cap Chip 100000 PF +80-20% Y5V
C242	2113743M24	Cap Chip 100000 PF +80-20% Y5V
C243	Not Placed	GCAM Dummy Part Number
C244	2113928N01	Cap Cer Chip 0.1UF 10% 6.3
C245	2113928N01	Cap Cer Chip 0.1UF 10% 6.3
C246	2113743N38	Cap Chip 33.0 PF 5% COG
C247	2113743N38	Cap Chip 33.0 PF 5% COG
C248	2113743N38	Cap Chip 33.0 PF 5% COG
C249	2113928C04	Cap Cer Chip 4.7UF 6.3V10%0805
C250	2113743M24	Cap Chip 100000 PF +80-20% Y5V
C251	2113743N38	Cap Chip 33.0 PF 5% COG
C252	2113928K09	Cap Cer Chip 10.0 UF 6.3V 10%
C253	2113743L41	Cap Chip 10000 PF 10% X7R
C254	2113928A01	Cap Cer Chip 1.0 UF1 0V
C256	Not Placed	GCAM Dummy Part Number
C257	Not Placed	GCAM Dummy Part Number
C258	2113928C04	Cap Cer Chip 4.7UF 6.3V10%0805
C259	2113928C04	Cap Cer Chip 4.7UF 6.3V10%0805
C260	Not Placed	GCAM Dummy Part Number
C261	2113928C04	Cap Cer Chip 4.7UF 6.3V10%0805
C265	Not Placed	GCAM Dummy Part Number
C267	2113743L17	Cap Chip 1000 PF 10% X7R
C269	2113743M24	Cap Chip 100000 PF +80-20% Y5V
C270	2113928N01	Cap Cer Chip 0.1UF 10% 6.3
C271	2113928D08	Cap Ceramic Chip 10.0UF
C272	Not Placed	GCAM Dummy Part Number
C273	2113743H14	Cap Chip 10.0 UF 16V +80-20%
C274	2113928N01	Cap Cer Chip 0.1UF 10% 6.3
C275	2113743N38	Cap Chip 33.0 PF 5% COG
C276	2113743N38	Cap Chip 33.0 PF 5% COG
C277	2113743N38	Cap Chip 33.0 PF 5% COG
C278	2113743N38	Cap Chip 33.0 PF 5% COG
C279	2113743N41	Cap Chip 43.0 PF 5% COG
C280	2113743T19	Cap 10UF 16V Cer 3225 X5R
C282	2311049A97	Cap Tant Chip 33 UF 16V 20%
C283	2113928N01	Cap Cer Chip 0.1UF 10% 6.3
C285	2113928A01	Cap Cer Chip 1.0 UF1 0V
C286	2113743L03	Cap Metal/poly Film 0.1
C287	2113743L17	Cap Chip 1000 PF 10% X7R
C290	2113743L03	Cap Metal/poly Film 0.1
C291	2113928N01	Cap Cer Chip 0.1UF 10% 6.3
C292	2113743L03	Cap Metal/poly Film 0.1
C293	2113928N01	Cap Cer Chip 0.1UF 10% 6.3
C294	2113743L03	Cap Metal/poly Film 0.1
C295	2113928N01	Cap Cer Chip 0.1UF 10% 6.3
C296	2113743M24	Cap Chip 100000 PF +80-20% Y5V
C297	2113743N38	Cap Chip 33.0 PF 5% COG
C298	2113741F47	Cap Chip CL2 X7R Reel 8200
C299	2113743N38	Cap Chip 33.0 PF 5% COG
C300	2113743L41	Cap Chip 10000 PF 10% X7R
C301	2113743M24	CAP CHIP 100000 PF +80-20% Y5V
C302	2113743M24	Cap Chip 100000 PF +80-20% Y5V
C303	2113743L41	Cap Chip 10000 PF 10% X7R
C304	2113741F45	Cap Chip CL2 X7R Reel 6800
C305	2113741F49	Cap Chip CL2 X7R Reel 10000
C306	2311049A59	Cap Tant Chip A/P 10UF 10% 6V
C307	2113743M24	Cap Chip 100000 PF +80-20% Y5V
C308	2113743N38	Cap Chip 33.0 PF 5% COG
C309	2113928P04	Cap Cer Chip 1.0UF 20% 6.3V
C310	2113743N38	Cap Chip 33.0 PF 5% COG
C311	2113928P04	Cap Cer Chip 1.0UF 20% 6.3V
C312	2311049A59	Cap Tant Chip A/P 10UF 10% 6V
C313	2113743M24	Cap Chip 100000 PF +80-20% Y5V
C314	2113743M24	Cap Chip 100000 PF +80-20% Y5V
C315	2113743M24	Cap Chip 100000 PF +80-20% Y5V
C316	2113743M24	Cap Chip 100000 PF +80-20% Y5V
C317	2113743L41	Cap Chip 10000 PF 10% X7R
C318	2113743M24	Cap Chip 100000 PF +80-20% Y5V
C319	2113743M24	Cap Chip 100000 PF +80-20% Y5V
C320	2113743L41	Cap Chip 10000 PF 10% X7R
C321	2113743M24	Cap Chip 100000 PF +80-20% Y5V
C322	2113743L41	Cap Chip 10000 PF 10% X7R
C323	2113743M24	Cap Chip 100000 PF +80-20% Y5V
C324	2113743M24	Cap Chip 100000 PF +80-20% Y5V
C325	2113743L41	Cap Chip 10000 PF 10% X7R
C326	2113743M24	Cap Chip 100000 PF +80-20% Y5V
C327	2113743L41	Cap Chip 10000 PF 10% X7R
C450	2113928K09	Cap Cer Chip 10.0 UF 6.3V 10%
C451	2113928K09	Cap Cer Chip 10.0 UF 6.3V 10%
C455	2113743N38	Cap Chip 33.0 PF 5% COG
C456	2113743N38	Cap Chip 33.0 PF 5% COG
C457	2113743N38	Cap Chip 33.0 PF 5% COG
C458	2113743N03	Cap Chip 1.0 PF +-.25PF COG
C459	2113743N08	Cap Chip 1.6 PF +-.25PF COG
C460	2113743N38	Cap Chip 33.0 PF 5% COG
C461	2113743N41	Cap Chip 43.0 PF 5% COG
C462	2113743N41	Cap Chip 43.0 PF 5% COG

Circuit Ref	Motorola Part No.	Description
C466	2113743L41	Cap Chip 10000 PF 10% X7R
C467	2113743N41	Cap Chip 43.0 PF 5% COG
C469	2113743K16	Cap Chip .220 UF +80-20% 16V
C470	Not Placed	GCAM Dummy Part Number
C471	2113743L41	Cap Chip 10000 PF 10% X7R
C472	2113743L37	Cap Chip 6800 PF 10% X7R
C473	2113743L10	Cap Chip 510 PF 10% X7R
C475	2113743N41	Cap Chip 43.0 PF 5% COG
C476	2113743N19	Cap Chip 5.1 PF +-.5PF COG
C477	2113743N19	Cap Chip 5.1 PF +-.5PF COG
C478	2113743N03	Cap Chip 1.0 PF +-.25PF COG
C479	2113743N19	Cap Chip 5.1 PF +-.5PF COG
C480	2113743N11	Cap Chip 2.4 PF +-.25PF COG
C481	2113743N11	Cap Chip 2.4 PF +-.25PF COG
C482	2113743N19	Cap Chip 5.1 PF +-.5PF COG
C483	2113743N41	Cap Chip 43.0 PF 5% COG
C484	2113743N12	Cap Chip 2.7 PF +-.25PF COG
C485	2113743N20	Cap Chip 5.6 PF +-.5PF COG
C486	Not Placed	GCAM Dummy Part Number
C487	2113743N41	Cap Chip 43.0 PF 5% COG
C488	2113743N41	Cap Chip 43.0 PF 5% COG
C489	2113743N03	Cap Chip 1.0 PF +-.25PF COG
C490	2113743N41	Cap Chip 43.0 PF 5% COG
C491	2113743N41	Cap Chip 43.0 PF 5% COG
C493	2113743L41	Cap Chip 10000 PF 10% X7R
C494	2170282A03	High Cap MLCC,4.7UF
C495	2170282A03	High Cap MLCC,4.7UF
C500	2113743N22	Cap Chip 6.8 PF +-.5PF COG
C501	2113743L41	Cap Chip 10000 PF 10% X7R
C508	2113743N38	Cap Chip 33.0 PF 5% COG
C510	2113743N38	Cap Chip 33.0 PF 5% COG
C511	2113743M24	Cap Chip 100000 PF +80-20% Y5V
C512	2113743N38	Cap Chip 33.0 PF 5% COG
C514	2113743N15	Cap Chip 3.6 PF +-.25PF COG
C516	2113743N38	Cap Chip 33.0 PF 5% COG
C517	2113743M24	Cap Chip 100000 PF +80-20% Y5V
C519	Not Placed	GCAM Dummy Part Number
C522	2113743N26	Cap Chip 10.0 PF 5% COG
C523	2113743N26	Cap Chip 10.0 PF 5% COG
C524	2113743N38	Cap Chip 33.0 PF 5% COG
C527	2113743M24	Cap Chip 100000 PF +80-20% Y5V

Circuit Ref	Motorola Part No.	Description
C528	2113743N54	Cap Chip 150 PF 5% COG
C529	Not Placed	GCAM Dummy Part Number
C530	2113743N18	Cap Chip 4.7 PF +-.25PF COG
C531	2113743L17	Cap Chip 1000 PF 10% X7R
C533	2113743N38	Cap Chip 33.0 PF 5% COG
C534	2113743N34	Cap Chip 22.0 PF 5% COG
C535	2113743N39	Cap Chip 36.0 PF 5% COG
C536	2170282A03	High Cap MLCC,4.7UF
C537	2113743N23	Cap Chip 7.5 PF +-.5PF COG
C538	2113740L02	Cap Cer Chip 2.2 PF+-0.1PF
C539	2113740F13	Cap Chip Reel CL1 +/-30 2.7
C540	2113743N23	Cap Chip 7.5 PF +-.5PF COG
C601	2113743L05	Cap Chip 330 PF 10% X7R
C602	2113743N38	Cap Chip 33.0 PF 5% COG
C605	2113928N01	Cap Cer Chip 0.1UF 10% 6.3
C606	2113928N01	Cap Cer Chip 0.1UF 10% 6.3
C607	2113928N01	Cap Cer Chip 0.1UF 10% 6.3
C608	2113743E12	Cap Chip .047UF 10% X7R
C609	2113743L29	Cap Chip 3300PF 10% X7R
C610	2113928N01	Cap Cer Chip 0.1UF 10% 6.3
C611	2113928N01	Cap Cer Chip 0.1UF 10% 6.3
C612	2113743E03	Cer Chip Cap .015UF
C614	2113743L41	Cap Chip 10000 PF 10% X7R
C615	2113743L17	Cap Chip 1000 PF 10% X7R
C616	2113928N01	Cap Cer Chip 0.1UF 10% 6.3
C617	2113928N01	Cap Cer Chip 0.1UF 10% 6.3
C618	2113928N01	Cap Cer Chip 0.1UF 10% 6.3
C619	2113928N01	Cap Cer Chip 0.1UF 10% 6.3
C620	2113928N01	Cap Cer Chip 0.1UF 10% 6.3
C626	2113928N01	Cap Cer Chip 0.1UF 10% 6.3
C629	2113928N01	Cap Cer Chip 0.1UF 10% 6.3
C635	2113743L03	Cap Metal/poly Film 0.1
C636	2113743L03	Cap Metal/poly Film 0.1
C640	2113743L21	Cap Chip 1500 PF 10% X7R
C641	2113743M24	Cap Chip 100000 PF +80-20% Y5V
C643	0885126C07	Cap 0.1 UF Poly
C644	0885126C07	Cap 0.1 UF Poly
C645	0885126C07	Cap 0.1 UF Poly
C646	0885126C07	Cap 0.1 UF Poly
C647	2113928N01	Cap Cer Chip 0.1UF 10% 6.3
C651	2113743L41	Cap Chip 10000 PF 10% X7R
C652	2113743L41	Cap Chip 10000 PF 10% X7R
C653	Not Placed	GCAM Dummy Part Number
C700	2113743N38	Cap Chip 33.0 PF 5% COG
C701	2113743N12	Cap Chip 2.7 PF +-.25PF COG
C702	2113743N12	Cap Chip 2.7 PF +-.25PF COG
C703	2113743N09	Cap Chip 2.0PF +-.25PF COG

Circuit Ref	Motorola Part No.	Description
C704	2113743N11	Cap Chip 2.4 PF +-.25PF COG
C705	2113743N08	Cap Chip 1.6 PF +-.25PF COG
C706	2113743N11	Cap Chip 2.4 PF +-.25PF COG
C709	2113743N38	Cap Chip 33.0 PF 5% COG
C710	2113743N38	Cap Chip 33.0 PF 5% COG
C711	2113743L17	Cap Chip 1000 PF 10% X7R
C712	2113743N38	Cap Chip 33.0 PF 5% COG
C713	2113743N38	Cap Chip 33.0 PF 5% COG
C718	2113743N03	Cap Chip 1.0 PF +-.25PF COG
C720	Not Placed	GCAM Dummy Part Number
C724	2113743N12	Cap Chip 2.7 PF +-.25PF COG
C725	2113743N38	Cap Chip 33.0 PF 5% COG
C726	2113743N03	Cap Chip 1.0 PF +-.25PF COG
C727	Not Placed	GCAM Dummy Part Number
C728	2113743N38	Cap Chip 33.0 PF 5% COG
C731	2113743N34	Cap Chip 22.0 PF 5% COG
C732	2113743L05	Cap Chip 330 PF 10% X7R
C734	2113743L03	Cap Metal/poly Film 0.1
C735	2113743L17	Cap Chip 1000 PF 10% X7R
C737	2113743L17	Cap Chip 1000 PF 10% X7R
C738	2113743M08	Cap Chip 22000PF +80-20% Y5V
C739	2113743L21	Cap Chip 1500 PF 10% X7R
C740	2113743N21	Cap Chip 6.2 PF + -,5PF COG
C741	2113743N16	Cap Chip 3.9 PF +-.25PF COG
C742	2113743N24	Cap Chip 8.2 PF + -.5PF COG
C743	2113743N26	Cap Chip 10.0 PF 5% COG
C744	2113743N26	Cap Chip 10.0 PF 5% COG
C745	2113743M24	Cap Chip 100000 PF +80-20% Y5V
C746	2113928N01	Cap Cer Chip 0.1UF 10% 6.3
C748	2113743N44	Cap Chip 56.0 PF 5% COG
C750	2113743N50	Cap Chip 100 PF 5% COG
C751	2113743N54	Cap Chip 150 PF 5% COG
C800	2113928N01	Cap Cer Chip 0.1UF 10% 6.3
C801	2113743N41	Cap Chip 43.0 PF 5% COG
C802	2113743N41	Cap Chip 43.0 PF 5% COG
C803	2113743N41	Cap Chip 43.0 PF 5% COG
C804	2113743N41	Cap Chip 43.0 PF 5% COG
C805	2311049J11	Capacitor Tant 10% 4.7UF
C806	2113928N01	Cap Cer Chip 0.1UF 10% 6.3
C807	2113743N41	Cap Chip 43.0 PF 5% COG
C808	2113928N01	Cap Cer Chip 0.1UF 10% 6.3
C809	2113928N01	Cap Cer Chip 0.1UF 10% 6.3

Circuit Ref	Motorola Part No.	Description
C810	2113928N01	Cap Cer Chip 0.1UF 10% 6.3
C811	2113928N01	Cap Cer Chip 0.1UF 10% 6.3
C812	2113743N41	Cap Chip 43.0 PF 5% COG
C813	2113743N41	Cap Chip 43.0 PF 5% COG
C814	2113743M08	Cap Chip 22000PF +80-20% Y5V
C815	2113743N41	Cap Chip 43.0 PF 5% COG
C816	2113741F45	Cap Chip CL2 X7R Reel 6800
C817	2113743E07	Cer Chip Cap .022UF
C818	2113743E07	Cer Chip Cap .022UF
C819	2113741F41	Cap Chip CL2 X7R Reel 4700
C820	2113741F41	Cap Chip CL2 X7R Reel 4700
C821	2113743E07	Cer Chip Cap .022UF
C822	2113743N41	Cap Chip 43.0 PF 5% COG
C823	2113743N41	Cap Chip 43.0 PF 5% COG
C824	2113743E07	Cer Chip Cap .022UF
C825	2113743N41	Cap Chip 43.0 PF 5% COG
C826	2113743N41	Cap Chip 43.0 PF 5% COG
C827	Not Placed	GCAM Dummy Part Number
C828	2113743N12	Cap Chip 2.7 PF +-.25PF COG
C829	2113743N41	Cap Chip 43.0 PF 5% COG
C830	2113743N41	Cap Chip 43.0 PF 5% COG
C831	2113743N41	Cap Chip 43.0 PF 5% COG
C832	2113743M08	Cap Chip 22000PF +80-20% Y5V
C833	2113743N41	Cap Chip 43.0 PF 5% COG
C835	2113743N41	Cap Chip 43.0 PF 5% COG
C836	2113743N41	Cap Chip 43.0 PF 5% COG
C844	2113743N41	Cap Chip 43.0 PF 5% COG
C845	Not Placed	GCAM Dummy Part Number
C846	Not Placed	GCAM Dummy Part Number
C848	2113743N41	Cap Chip 43.0 PF 5% COG
C849	2113743N41	Cap Chip 43.0 PF 5% COG
C850	2113743N41	Cap Chip 43.0 PF 5% COG
C851	2113743N41	Cap Chip 43.0 PF 5% COG
C852	2113743N41	Cap Chip 43.0 PF 5% COG
C853	Not Placed	GCAM Dummy Part Number
C901	2113743N41	Cap Chip 43.0 PF 5% COG
C902	2311049C49	Cap Tant Chip 100 UF 10% 16V
C903	2311049C49	Cap Tant Chip 100 UF 10% 16V
C904	2311049C49	Cap Tant Chip 100 UF 10% 16V
C907	2113743N41	Cap Chip 43.0 PF 5% COG
C908	2113743M08	Cap Chip 22000PF +80-20% Y5V
C909	2113743M08	Cap Chip 22000PF +80-20% Y5V

Circuit Ref	Motorola Part No.	Description
C910	2113743M08	Cap Chip 22000PF +80-20% Y5V
C912	2113743N12	Cap Chip 2.7 PF +-.25PF COG
C913	2113743N41	Cap Chip 43.0 PF 5% COG
C914	2113743N41	Cap Chip 43.0 PF 5% COG
C915	2113743N23	Cap Chip 7.5 PF +-.5PF COG
C916	Not Placed	GCAM Dummy Part Number
C918	2113743N32	Cap Chip 18.0 PF 5% COG
C920	Not Placed	GCAM Dummy Part Number
C921	2113743N41	Cap Chip 43.0 PF 5% COG
C922	Not Placed	GCAM Dummy Part Number
C924	2113743N41	Cap Chip 43.0 PF 5% COG
C926	2113743M08	Cap Chip 22000PF +80-20% Y5V
C927	2113740L18	Cap Cer Chip 10.0 PF +/-.25PF
C928	Not Placed	GCAM Dummy Part Number
C931	2113743N21	Cap Chip 6.2 PF + -,5PF COG
C932	2113743N41	Cap Chip 43.0 PF 5% COG
C933	2113740F42	Cap Chip Reel CL1 +/-30 43
C934	2113743N41	Cap Chip 43.0 PF 5% COG
C935	2113740F42	Cap Chip Reel CL1 +/-30 43
C936	2113740L03	Cap Cer Chip 2.4PF +-0.1PF
C937	2113743N41	Cap Chip 43.0 PF 5% COG
C938	2113743N03	Cap Chip 1.0 PF +-.25PF COG
C939	2113743N20	Cap Chip 5.6 PF +-.5PF COG
C940	2113743N41	Cap Chip 43.0 PF 5% COG
C941	2113743N41	Cap Chip 43.0 PF 5% COG
C942	2113743N41	Cap Chip 43.0 PF 5% COG
C943	2113740L05	Cap Cer Chip 3.0 PF+/-0.1PF
C944	2113740F03	Cap Chip Reel CL1 +/-30 1.0
C948	2113740F07	Cap Chip Reel CL1 +/-30 1.5
C949	2113740F42	Cap Chip Reel CL1 +/-30 43
C950	2113743M08	Cap Chip 22000PF +80-20% Y5V
C951	2113743N41	Cap Chip 43.0 PF 5% COG
C955	2113928N01	Cap Cer Chip 0.1UF 10% 6.3
C956	Not Placed	GCAM Dummy Part Number
C957	2113928N01	Cap Cer Chip 0.1UF 10% 6.3
C958	Not Placed	GCAM Dummy Part Number
C961	2113743N41	Cap Chip 43.0 PF 5% COG
C962	2113743N41	Cap Chip 43.0 PF 5% COG
C963	Not Placed	GCAM Dummy Part Number
C964	2113928N01	Cap Cer Chip 0.1UF 10% 6.3
C965	2113740L10	Cap Cer Chip 4.7 PF +-0.1PF
C966	2113740L13	Cap Cer Chip 6.2PF +-0.1PF
C967	Not Placed	GCAM Dummy Part Number
C968	2113928N01	Cap Cer Chip 0.1UF 10% 6.3
C969	2113743E05	Cer Chip Cap .018UF

Circuit Ref	Motorola Part No.	Description
D001	4809118D03	Led Red/Grn RT ANGL 2X3MM SMD
D100	4802245J47	Diode Schottky Bar-rier(RB471E)
D101	4802245J47	Diode Schottky Bar-rier(RB471E)
D202	4813833A19	Diode Schottky 1A 20V PWR-MITE
D203	4813833A19	Diode Schottky 1A 20V PWR-MITE
D460	4809877C13	Diode Varactor ISV305 SMD
D500	4813825A19	Diode Schottky Barrier Series
D700	4809877C13	Diode Varactor Isv305 Smd
D701	4809877C13	Diode Varactor Isv305 Smd
D730	4809877C13	Diode Varactor Isv305 Smd
D802	4885908A02	Diode RF Pin
D803	4885908A02	Diode RF Pin
D901	4809948D13	Diode RF Switch BA892 ESC
D903	4809948D13	Diode RF Switch BA892 ESC
E001	2486132Z01	BK20104M601 Ferrite Bead Array
E002	2486132Z01	BK20104M601 Ferrite Bead Array
E003	2486132Z01	BK20104M601 Ferrite Bead Array
E004	2480640Z01	C/IND BK1005HM471 Bead
E005	2480640Z01	C/IND BK1005HM471 Bead
E100	2480640Z01	C/IND BK1005HM471 Bead
E200	2480675U01	0805 CHIP-3AMP
E201	2409134J04	Ind Chip Fer Fltr 600 0603
E202	2409134J04	Ind Chip Fer Fltr 600 0603
E203	2409134J04	Ind Chip Fer Fltr 600 0603
E204	2409134J04	Ind Chip Fer Fltr 600 0603
E205	2480675U01	0805 Chip-3Amp
E206	2480675U01	0805 Chip-3Amp
E207	2480675U01	0805 Chip-3Amp
E208	2480675U01	0805 Chip-3Amp
E210	2409134J04	Ind Chip Fer Fltr 600 0603
E211	2409134J04	Ind Chip Fer Fltr 600 0603
E212	2480675U01	0805 Chip-3Amp
E215	2409134J04	Ind Chip Fer Fltr 600 0603
E300	2480067M02	CHK RF Chip Bead Inductor
E301	2480067M02	CHK RF Chip Bead Inductor
E302	2480067M02	CHK RF Chip Bead Inductor
E500	2480640Z01	C/IND BK1005HM471 Bead
E501	2480640Z01	C/IND BK1005HM471 Bead
E806	2409134J04	Ind Chip Fer Fltr 600 0603
E807	2409134J04	Ind Chip Fer Fltr 600 0603
E808	7608671Y02	Ferrite Bead 500 Ohm SMD PKG
E810	7686949J02	Ferrite Bead Chip-0402 Size

Circuit Ref	Motorola Part No.	Description
E811	7686949J02	Ferrite Bead Chip-0402 Size
F200	6586221J04	Fuse 2.5A 16V SMD
FL500	9186121Z01	850-870 MHz Bandpass SAW Filter
FL501	9186121Z01	850-870 MHz Bandpass SAW Filter
FL502	9186323Z01	Fltr 3 POL SURF MT Xtal 109.65
FL503	9164626E02	Thin-FI L P FIT LP085A0967AWTR
FL801	5885915B01	Isolator (Wideband)
H800	2680499Z01	Heat Spreader
J001	0986237A02	Connector (Contact Battery)
J002	0986017Z01	Connector, 24 Pin Socket
J100	0905505Y04	Conn Zif Horizontal
J110	0980472U01	Connector 16Pos Right Angle
J800	2880658Z03	Connector (SMA)
L200	2408603Y01	Inductor 4.7UH
L201	2486085A02	SMT Power Inductor 15UH +/-20%
L202	2404927K02	Inductor Power 47UH +-20%
L458	2485930A19	IND 100NH 5%
L459	2413926G10	IND 18.0 NH 5%
L461	2462587V35	Chip Ind 120 NH 5% 0805
L462	2485930A19	IND 100NH 5%
L463	2485930A19	IND 100NH 5%
L464	2485930A19	IND 100NH 5%
L465	2413926G04	IND 5.6 NH +/- 0.3 NH
L466	2413926G04	IND 5.6 NH +/- 0.3 NH
L500	2487319K17	Ind Cer WW 19NH 5% 1005 SMD
L501	2409377M03	Ind Chip WW 6.8 NH 5% 1608
L502	2487319K15	Ind Cer WW 12NH 5% 1005 SMD
L503	2409377M36	Ind Chip WW 220 NH 5% 1608
L505	2487319K12	IND Cer WW 9NH 5% 1005 SMD
L507	2409377M36	Ind Chip WW 220 NH 5% 1608
L508	2409377M36	Ind Chip WW 220 NH 5% 1608
L509	2462587V41	Ind Chip 390 NH 10%
L510	2462587V41	Ind Chip 390 NH 10%
L513	2409377M05	Ind Chip WW 12 NH 5% 1608
L514	2409377M19	Ind Chip WW 22 NH 5% 1608
L520	2487319K10	Ind Cer WW 7.5NH 5% 1005 SMD
L603	2487319K20	Ind Cer WW 36NH 5% 1005 SMD

Circuit Ref	Motorola Part No.	Description
L700	2409377M17	Ind Chip WW 100 NH 5% 1608
L701	2409377M17	Ind Chip WW 100 NH 5% 1608
L702	2409377M17	Ind Chip WW 100 NH 5% 1608
L703	2409377M17	Ind Chip WW 100 NH 5% 1608
L704	2487319K13	Ind Cer WW 10NH 5% 1005 SMD
L705	2409377M17	Ind Chip WW 100 NH 5% 1608
L706	2487319K16	Ind Cer WW 15NH 5% 1005 SMD
L730	2413926G15	IND 47.0 NH 5%
L731	2409134J04	Ind Chip Fer Fltr 600 0603
L732	2487319K15	Ind Cer WW 12NH 5% 1005 SMD
L800	2409377M36	Ind Chip WW 220 NH 5% 1608
L801	2409377M36	Ind Chip WW 220 NH 5% 1608
L807	2409377M04	Ind Chip WW 10 NH 5% 1608
L808	2409377M36	Ind Chip WW 220 NH 5% 1608
L900	2409377M36	Ind Chip WW 220 NH 5% 1608
L901	2409377M03	Ind Chip WW 6.8 NH 5% 1608
L902	2409377M02	Ind Chip WW 3.9 NH 5% 1608
L904	2113740F05	Cap Chip Reel CL1 +/-30 1.2
L905	0662057B47	Chip Res 0 Ohms +-.050 Ohms
L906	2485973Z01	Toko’s XS-3P wire-wound chip
L908	2485973Z10	TTOKO’S XS-3P Wire-wound Inductor
L909	2409377M36	Ind Chip WW 220 NH 5% 1608
L910	2413926G12	IND 27.0 NH 5%
L911	2485973Z07	Toko’s XS-3P wire-wound inductor
L912	2485973Z06	TOKO’S XS-3P Wire-wound Inductor (9
L914	2409377M36	Ind Chip WW 220 NH 5% 1608
L915	2485973Z07	Toko’s XS-3P wire-wound inductor
L918	Not Placed	GCAM Dummy Part Number
Q100	5102463J80	FDC6330L Integrated load switch
Q101	5102463J80	FDC6330L Integrated load switch

Circuit Ref	Motorola Part No.	Description
Q102	4809939C05	Tstr Dual NPN/PNP UMH 5
Q103	4802245J54	UMG5N Digital Transistor
Q201	5102463J80	FDC6330L Integrated load switch
Q202	4805128M27	SOT Trans
Q204	4802245J54	UMG5N Digital Transistor
Q459	4805793Y01	Trans Mini SOT NPN Low Noise
Q460	4805723X02	Trans Dual PNP UMT1N ROHM
Q463	4805793Y01	Trans Mini SOT NPN Low Noise
Q464	4805793Y01	Trans Mini SOT NPN Low Noise
Q465	4802245J88	Isolated Dual (NPN-PNP) Transistor
Q466	4805793Y01	Trans Mini SOT NPN Low Noise
Q467	4802245J88	Isolated Dual (NPN-PNP) Transistor
Q500	4809939C05	Tstr Dual NPN/PNP UMH 5
Q501	4809939C05	Tstr Dual NPN/PNP UMH 5
Q700	4805793Y01	Trans Mini SOT NPN Low Noise
Q702	4805793Y01	Trans Mini SOT NPN Low Noise
Q703	4809939C05	Tstr Dual NPN/PNP UMH 5
Q730	4805793Y01	Trans Mini SOT NPN Low Noise
Q731	4805723X03	Trans Dual NPN-PNP UMD3N ROHM
Q800	4813828A09	Tstr 8W 450MHZ 7.5V
Q801	4809939C05	Tstr Dual NPN/PNP UMH 5
Q805	4809939C05	Tstr Dual NPN/PNP UMH 5
Q806	4809939C05	Tstr Dual NPN/PNP UMH 5
R001	0662057M74	Res. Chip 1000 5% 20X40
R002	0662057M74	Res. Chip 1000 5% 20X40
R003	0662057N13	Res. Chip 39K 5% 20X40
R004	0662057N13	Res. Chip 39K 5% 20X40
R005	0662057N13	Res. Chip 39K 5% 20X40
R006	0662057N13	Res. Chip 39K 5% 20X40
R007	0662057N13	Res. Chip 39K 5% 20X40
R008	0662057N13	Res. Chip 39K 5% 20X40
R009	0662057N13	Res. Chip 39K 5% 20X40
R010	Not Placed	GCAM Dummy Part Number
R100	Not Placed	GCAM Dummy Part Number
R101	0662057N13	Res. Chip 39K 5% 20X40
R102	0662057N13	Res. Chip 39K 5% 20X40
R103	0662057N13	Res. Chip 39K 5% 20X40
R106	2486261Z01	BLM18BA470SN1-EMIFIL Chip Ferrite Bead
R107	2486261Z01	BLM18BA470SN1-EMIFIL Chip Ferrite Bead
R108	0662057A85	Chip Res 33K Ohm 5%
R109	0686135Z01	Current Sensor Resistor (0.1ohm)
R110	0662057A73	Chip Res 10K OHMS 5%
R111	0662057A73	Chip Res 10K OHMS 5%
R112	0662057N01	Res. Chip 12K 5% 20X40
R113	0662057M95	Res. Chip 7500 55 20X40
R114	0662057A85	Chip Res 33K OHM 5%
R115	0662057N13	Res. Chip 39K 5% 20X40
R116	0662057M82	Res. Chip 2200 5% 20X40
R117	0662057N13	Res. Chip 39K 5% 20X40
R118	0662057N17	Res. Chip 56K 5% 20X40
R119	0662057M74	Res. Chip 1000 5% 20X40
R120	0662057M74	Res. Chip 1000 5% 20X40
R121	2486261Z01	BLM18BA470SN1-EMIFIL Chip Ferrite Bead
R122	2486261Z01	BLM18BA470SN1-EMIFIL Chip Ferrite Bead
R202	0662057N15	Res. Chip 47K 5% 20X40
R203	0662057N15	Res. Chip 47K 5% 20X40
R204	0662057N15	Res. Chip 47K 5% 20X40
R205	0662057N17	Res. Chip 56K 5% 20X40
R206	0662057M96	Res. Chip 8200 5% 20X40
R207	0662057M96	Res. Chip 8200 5% 20X40
R208	0662057B20	Chip Res 820K OHMS 5%
R209	0662057M82	Res. Chip 2200 5% 20X40
R210	0662057N11	Res. Chip 33K 5% 20X40
R211	0662057M93	Res. Chip 6200 5% 20X40
R212	0662057N11	Res. Chip 33K 5% 20X40
R213	0662057M82	Res. Chip 2200 5% 20X40
R214	0662057M82	Res. Chip 2200 5% 20X40
R215	0662057N30	Res. Chip 200K 5% 20X40
R216	Not Placed	GCAM Dummy Part Number
R217	0662057N13	Res. Chip 39K 5% 20X40
R218	Not Placed	GCAM Dummy Part Number
R220	0662057B05	Chip Res 200K Ohms 5%
R221	0662057N13	Res. Chip 39K 5% 20X40
R222	Not Placed	GCAM Dummy Part Number
R223	0662057M01	Res. Chip 0 5% 20X40
R225	0662057N13	Res. Chip 39K 5% 20X40
R229	0662057A85	Chip Res 33K OHM 5%
R230	0662057M96	Res. Chip 8200 5% 20X40
R232	0662057M50	Res. Chip 100 5% 20X40
R234	0662057M01	Res. Chip 0 5% 20X40
R235	0662057M01	Res. Chip 0 5% 20X40
R240	0662057N11	Res. Chip 33K 5% 20X40
R241	0662057N11	Res. Chip 33K 5% 20X40
R242	0662057M94	Res. Chip 6800 5% 20X40
R243	0662057M74	Res. Chip 1000 5% 20X40
R244	0662057M74	Res. Chip 1000 5% 20X40
R245	0662057M90	Res. Chip 4700 5% 20X40
R252	0662057N06	Res. Chip 20K 5% 20X40
R254	0662057V30	Res. Chip 130K 1% 1/16W
R255	0662057M26	Res. Chip 10 5% 20X40
R256	0662057N06	Res. Chip 20K 5% 20X40
R271	0662057M78	Res. Chip 1500 5% 20X40
R272	0662057N13	Res. Chip 39K 5% 20X40
R274	0662057N16	Res. Chip 51K 5% 20X40
R275	0662057N14	Res. Chip 43K 5% 20X40
R277	0662057B10	Chip Res 330K OHMS 5%
R278	0662057N06	Res. Chip 20K 5% 20X40
R279	0662057V30	Res. Chip 130K 1% 1/16W
R280	0662057M98	Res. Chip 10K 5% 20X40
R281	0662057M98	Res. Chip 10K 5% 20X40
R284	0662057N13	Res. Chip 39K 5% 20X40
R285	0662057N13	Res. Chip 39K 5% 20X40
R286	Not Placed	GCAM Dummy Part Number
R287	0662057N23	Res. Chip 100K 5% 20X40
R290	0662057M01	Res. Chip 0 5% 20X40
R294	Not Placed	GCAM Dummy Part Number
R295	0662057M01	Res. Chip 0 5% 20X40
R296	0662057A41	Chip Res 470 OHMS 5%
R297	0662057M01	Res. Chip 0 5% 20X40
R298	0662057M01	Res. Chip 0 5% 20X40
R300	0662057B47	Chip Res 0 Ohms +-.050 Ohms
R301	0662057B47	Chip Res 0 Ohms +-.050 Ohms
R302	0662057B47	Chip Res 0 Ohms +-.050 OHMS
R303	0662057B47	Chip Res 0 Ohms +-.050 Ohms
R304	0662057B47	CHIP RES 0 Ohms +-.050 Ohms
R305	0662057B47	Chip Res 0 Ohms +-.050 Ohms
R306	0662057B47	Chip Res 0 Ohms +-.050 Ohms
R307	0662057N13	Res. Chip 39K 5% 20X40
R308	0662057N13	Res. Chip 39K 5% 20X40
R309	0662057M01	Res. Chip 0 5% 20X40
R310	Not Placed	GCAM Dummy Part Number
R312	0662057A17	Res. Chip 47 Ohms 5%
R313	Not Placed	GCAM Dummy Part Number
R314	0662057N07	Res. Chip 22K 5% 20X40
R315	0662057M94	Res. Chip 6800 5% 20X40
R316	Not Placed	GCAM Dummy Part Number
R318	0662057M01	Res. Chip 0 5% 20X40
R319	0662057M01	Res. Chip 0 5% 20X40
R320	0662057M01	Res. Chip 0 5% 20X40
R321	Not Placed	GCAM Dummy Part Number
R322	Not Placed	GCAM Dummy Part Number
R323	0662057M01	Res. Chip 0 5% 20X40
R324	0662057N13	Res. Chip 39K 5% 20X40
R325	0662057M01	Res. Chip 0 5% 20X40
R452	0662057M43	Res. Chip 51 5% 20X40
R453	0662057M50	Res. Chip 100 5% 20X40
R454	0662057M84	Res. Chip 2700 5% 20X40
R456	0662057M87	Res. Chip 3600 5% 20X40
R457	0662057M30	Res. Chip 15 5% 20X40
R458	0662057M30	Res. Chip 15 5% 20X40
R459	0662057M30	Res. Chip 15 5% 20X40
R460	0662057M98	Res. Chip 10K 5% 20X40
R461	0662057N23	RES CHIP 100K 5% 20X40
R462	0662057M74	Res. Chip 1000 5% 20X40
R463	0662057M74	Res. Chip 1000 5% 20X40
R464	0662057M58	Res. Chip 220 5% 20X40
R465	0662057M01	Res. Chip 0 5% 20X40
R466	0662057N06	Res. Chip 20K 5% 20X40
R467	0662057M98	RES CHIP 10K 5% 20X40
R468	0662057M44	RES, CHIP 56 5% 20X40
R470	0662057M26	Res. Chip 10 5% 20X40
R471	0662057M50	Res. Chip 100 5% 20X40
R472	0662057M74	Res. Chip 1000 5% 20X40
R473	0662057M66	Res. Chip 470 5% 20X40
R474	0662057M26	Res. Chip 10 5% 20X40
R476	0662057M52	Res. Chip 120 5% 20X40
R477	0662057M74	Res. Chip 1000 5% 20X40
R478	0662057M70	Res. Chip 680 5% 20X40
R479	0662057M26	Res. Chip 10 5% 20X40
R480	Not Placed	GCAM Dummy Part Number
R481	Not Placed	GCAM Dummy Part Number
R482	0662057M66	Res. Chip 470 5% 20X40
R483	0662057M52	Res. Chip 120 5% 20X40
R498	0662057M74	Res. Chip 1000 5% 20X40
R499	0662057M52	Res. Chip 120 5% 20X40
R500	0662057M74	Res. Chip 1000 5% 20X40
R502	0662057M58	Res. Chip 220 5% 20X40
R506	Not Placed	GCAM Dummy Part Number
R509	0662057M32	Res. Chip 18 5% 20X40
R510	0662057M50	Res. Chip 100 5% 20X40
R511	0662057M40	Res. Chip 39 5% 20X40
R516	0662057M01	Res. Chip 0 5% 20X40
R528	0662057M60	Res. Chip 270 5% 20X40
R529	0662057M60	Res. Chip 270 5% 20X40
R602	Not Placed	GCAM Dummy Part Number
R603	0662057M82	Res. Chip 2200 5% 20X40
R604	0662057M38	Res. Chip 33 5% 20X40
R608	Not Placed	GCAM Dummy Part Number
R610	Not Placed	GCAM Dummy Part Number
R611	Not Placed	GCAM Dummy Part Number

Circuit Ref	Motorola Part No.	Description
R612	0662057M01	Res. Chip 0 5% 20X40
R621	0662057M92	Res. Chip 5600 5% 20X40
R623	0662057M46	Res. Chip 68 5% 20X40
R624	0662057M57	Res. Chip 200 5% 20X40
R627	0662057M01	Res. Chip 0 5% 20X40
R700	0662057M26	Res. Chip 10 5% 20X40
R701	0662057M57	Res. Chip 200 5% 20X40
R704	0662057M90	Res. Chip 4700 5% 20X40
R705	0662057M96	Res. Chip 8200 5% 20X40
R706	0662057M44	Res. Chip 56 5% 20X40
R707	0662057M01	Res. Chip 0 5% 20X40
R708	0662057M01	Res. Chip 0 5% 20X40
R709	0662057M87	Res. Chip 3600 5% 20X40
R710	0662057M87	Res. Chip 3600 5% 20X40
R711	0662057M60	Res. Chip 270 5% 20X40
R713	0662057M01	Res. Chip 0 5% 20X40
R733	0662057M89	Res. Chip 4300 5% 20X40
R734	0662057M82	Res. Chip 2200 5% 20X40
R735	0662057M98	RES CHIP 10K 5% 20X40
R736	0662057M60	Res. Chip 270 5% 20X40
R737	0662057N05	Res. Chip 18K 5% 20X40
R738	0662057M50	Res. Chip 100 5% 20X40
R800	0662057M50	Res. Chip 100 5% 20X40
R801	0662057M67	Res. Chip 510 5% 20X40
R802	0662057M43	Res. Chip 51 5% 20X40
R803	0662057M43	Res. Chip 51 5% 20X40
R804	0662057M43	Res. Chip 51 5% 20X40
R806	0662057B47	Chip Res 0 OhmS +-.050 Ohms
R807	0662057A93	Chip Res 68K OHMS 5%
R808	0662057M43	Res. Chip 39 5% 20X40
R809	0662057M92	Res. Chip 5600 5% 20X40
R810	0662057M43	Res. Chip 39 5% 20X40
R901	Not Placed	GCAM Dummy Part Number
R902	0662057M01	Res. Chip 0 5% 20X40
R908	0662057M01	Res. Chip 0 5% 20X40
R909	0662057M43	Res. Chip 51 5% 20X40
R910	Not Placed	GCAM Dummy Part Number
R911	0662057M32	Res. Chip 18 5% 20X40
R912	0662057M61	Res. Chip 300 5% 20X40
R913	0662057M56	Res. Chip 180 5% 20X40
R914	0662057M37	Res. Chip 30 5% 20X40
R915	0662057M56	Res. Chip 180 5% 20X40
R916	0662057M61	Res. Chip 300 5% 20X40
R919	0662057N07	Res. Chip 22K 5% 20X40
R920	Not Placed	GCAM Dummy Part Number
R921	0662057M01	Res. Chip 0 5% 20X40
R922	Not Placed	GCAM Dummy Part Number
R923	Not Placed	GCAM Dummy Part Number
R924	0662057N11	Res. Chip 33K 5% 20X40
R929	0662057N07	Res. Chip 22K 5% 20X40
R930	0662057M74	Res. Chip 1000 5% 20X40
R931	0662057A32	Chip Res 200 OHMS 5%
RT200	0686931J01	Termistor 47K
RT800	0686931J01	Termistor 47K
S001	4080710Z06	Frequency Switch (reflow 250oC)
S002	4070354A01	Light Touch Switch-SMD
S003	4070354A01	Light Touch Switch-SMD
S004	4070354A01	Light Touch Switch-SMD
S005	4070354A01	Light Touch Switch-SMD
S100	4070354A01	Light Touch Switch-SMD
SH200	2686114Z01	Primary Shield, GCAP3
SH201	2686120Z01	Primary Shield, Switching Regulator
SH300	2686110Z01	Primary Shield, Controller
SH301	2686119Z01	Primary Shield, Memories
SH400	2686106Z01	Primary Shield, ESCORT
SH500	2686115Z01	Primary Shield, RxFE1
SH501	2686116Z01	Primary Shield, RxFE2
SH600	2686117Z01	Primary Shield, WPIC
SH700	2686105Z01	Primary Shield, Main VCO
SH730	2686118Z01	Primary Shield, 2ND LO
SH800	2686109Z01	Primary Shield, ODCT1
SH801	2686113Z01	Primary Shield, ODCT2
SH900	2686107Z01	Primary Shield, Antenna SW & HF1
SH901	2686111Z01	Primary Shield, Antenna SW & HF2
SH902	2686108Z01	Primary Shield, PA1
SH903	2686112Z01	Primary Shield, PA2
T800	2585959A01	Transformer BALUN Ceramic
U001	5102463J90	NL27WZ16-Dual Buffer
U002	5102463J90	NL27WZ16-Dual Buffer
U005	9185759B01	Fltr RC Network
U100	9185759B01	Fltr RC Network
U101	9185759B01	Fltr RC Network
U102	9185759B01	Fltr RC Network
U103	9185759B01	Fltr RC Network
U104	9185759B01	Fltr RC Network
U105	9185759B01	Fltr RC Network
U111	5162852A62	IC MAX4373T, Low Cost MIRCPWR
U200	5109879E83	IC BICMOS GCAP3 V 2.6 179 BGA
U201	5102463J75	MAX1685 Step Down Regulator
U202	5102463J44	Audio Amplifier TDA8547TS
U205	5102463J82	ADP3331 Linear Voltage Regulator
U301	5185368C99	IC REDCAP 2 256 PIN BGA ROM3
U302	5109509A43	IC 512K X 16 1MB SRAM
U303	5102476J01	Intel 64MBIT Flash GE28F640C3
U304	5109522E22	IC Sngl And Gate TC7S08FU
U305	5102463J77	MC74HC1G04 NOT GATE
U307	5109522E22	IC Sngl And Gate TC7S08FU
U460	5185368C18	ESCORT IC IN 16 PIN QFN Package
U461	5102463J74	Bipolar Linear Regulator 4.5V
U500	5185368C01	IC 3V Low Noise AMP
U502	5102463J96	MMIC Mixer With IF Buffer
U601	5185368C21	WPIC 3.1
U730	5186226J12	PLL Dual Freq Synt. LMX2332
U800	5185130C65	IC VHF/UHF/800 MHz LDMOS Driver
U801	5886201Z01	CHIP Multilayer3DB/90Deg Splitter
U802	5102463J79	MAX5401 Low-Drift Digital Potentiometer
U803	5108428S43	Low Noise ODCT
U806	5102463J86	Coupler Without Internal Low Pass Filter(H)
U907	5162852A09	Low Pwr OP AMP W/Rail To Rail
VR001	4805656W08	Diode Zener Quad
VR002	4805656W08	Diode Zener Quad
VR006	4813830C11	Diode 3.9V ‘D3’ MMSZ5228BT1
VR007	4805656W08	Diode Zener Quad
VR008	4813830C11	Diode 3.9V ‘D3’ MMSZ5228BT1
VR009	4813830C26	Diode 13V ‘H3’ MMSZ5243BT1
VR100	4813830C26	Diode 13V ‘H3’ MMSZ5243BT1
VR101	4805656W08	Diode Zener Quad
VR102	4805656W08	Diode Zener Quad
VR103	4805656W08	Diode Zener Quad
VR104	4813830C26	Diode 13V ‘H3’ MMSZ5243BT1
VR105	4813830C26	Diode 13V ‘H3’ MMSZ5243BT1
VR106	4813830C11	Diode 3.9V ‘D3’ MMSZ5228BT1
VR201	4813830C26	Diode 13V ‘H3’ MMSZ5243BT1
Y200	4809995L05	Xtal Quartz 32.768KHZ CC4V-T1
Y460	4805911Z02	Resonator Ceramic
Y601	5102463J73	Ref Oscillator 16.8MHz, 1ppm, SMD,
Y700	4805911Z02	Resonator Ceramic

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Troubleshooting (800 MHz)

General

Troubleshooting faults in the radio require proper understanding of the different circuitry contained in the radio. Since the radio contains a highly integrated system, the software and hardware functions can not be separated easily. Thus, it is also necessary to understand the functioning of different ICs and the role of the software in the operation of the radio.

This service manual includes schematic diagrams, circuit board layouts, block diagrams, and troubleshooting procedures, which help a technician to troubleshoot a malfunctioning circuit and detect a defective component.

NOTE **The CPS has no capability to tune the radio. Tuning the radio can only be performed at the factory or at the appropriate Motorola Repair Centre. Components replacement can affect the radio tuning and must only be performed by the appropriate Motorola Repair Centre.**

The radio is tuned and tested at the factory. The results of the tuning procedures are stored in a special EEPROM. This information includes tuning and other system parameters. The area of the memory in the radio where the tuning information stored is called the “codeplug”. A radio codeplug can be read using the CPS programme.

Test Procedures

This section explains the procedures required to troubleshoot a MTP700 radio.

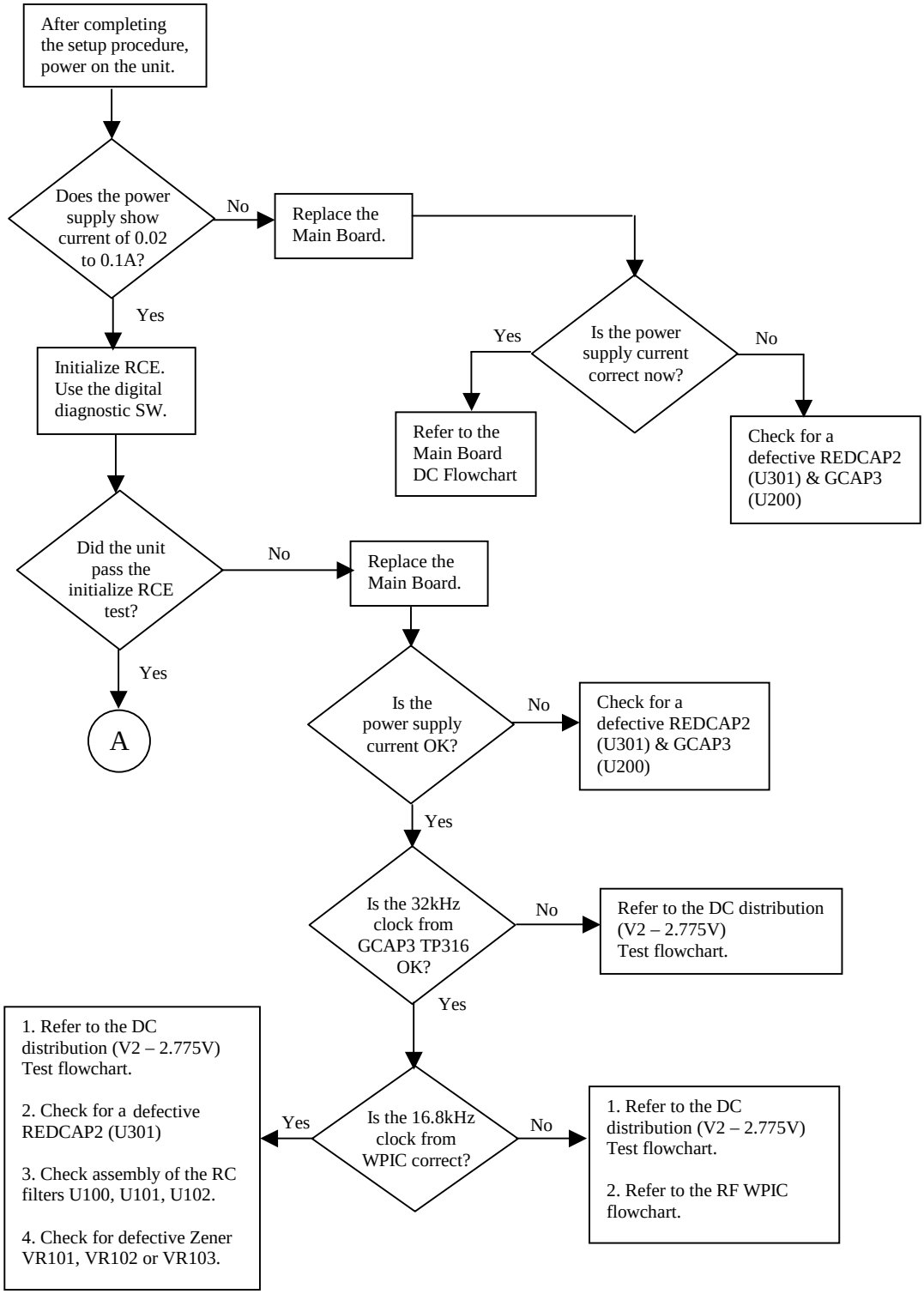
The digital tests should be performed using the GoNoGo PATS test and TETRACom SW. To use the TETRACom you must go to test mode by using the command <Test Enter>.

Troubleshooting Flowcharts

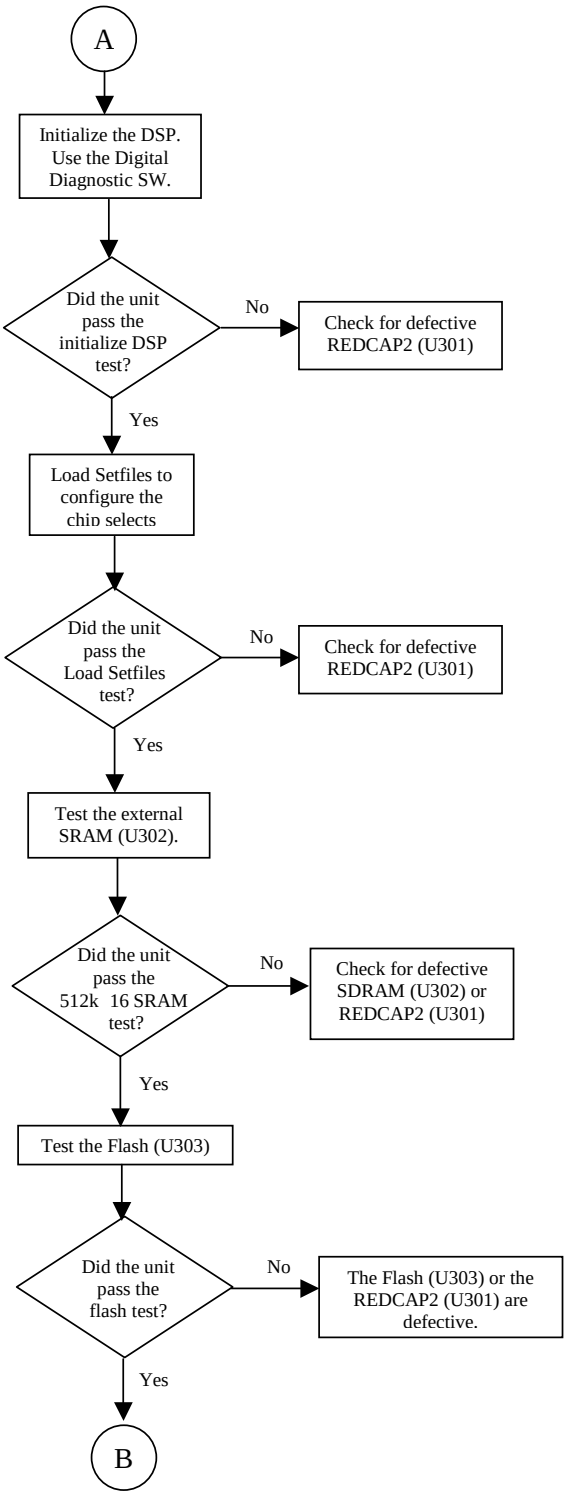
Use the following flowcharts to troubleshoot the radio. These flowcharts contain procedures using TETRACom SW application, GoNoGo PATS test and factory test modes for troubleshooting radios having digital, receiver, transmitter, or frequency generation test failures.

Digital Analysis Test

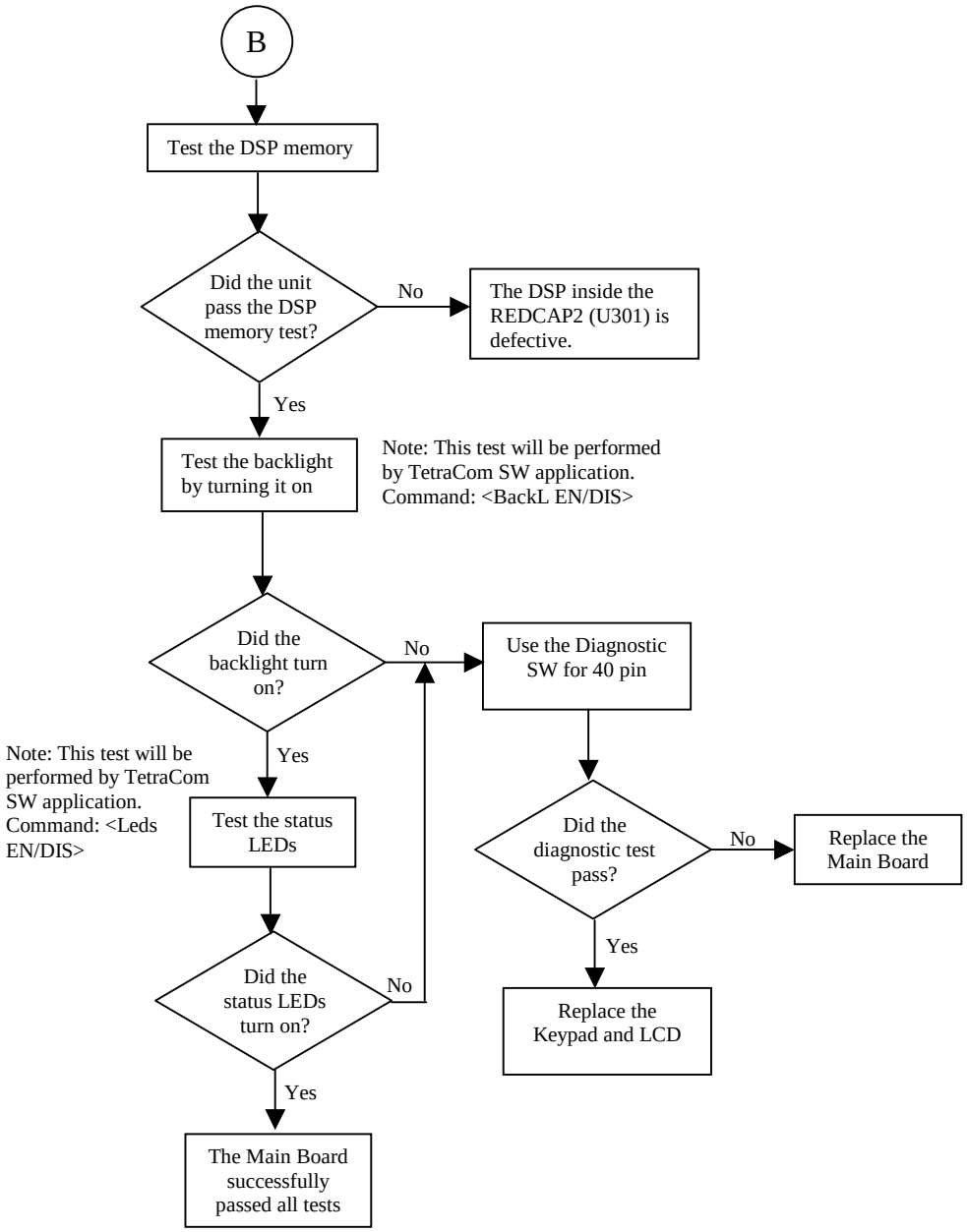
Use this test for troubleshooting the main board.


After completing the setup procedure, power on the unit.
Does the power supply show current of 0.02 to 0.1A?
No
Replace the Main Board.
Yes
Initialize RCE. Use the digital diagnostic SW.
Is the power supply current correct now?
Yes
No
Refer to the Main Board DC Flowchart
Check for a defective REDCAP2 (U301) & GCAP3 (U200)
Did the unit pass the initialize RCE test?
No
Replace the Main Board.
Yes
A
Is the power supply current OK?
No
Check for a defective REDCAP2 (U301) & GCAP3 (U200)
Yes
Is the 32kHz clock from GCAP3 TP316 OK?
No
Refer to the DC distribution (V2 – 2.775V) Test flowchart.
Yes
1. Refer to the DC distribution (V2 – 2.775V) Test flowchart.
2. Check for a defective REDCAP2 (U301)
3. Check assembly of the RC filters U100, U101, U102.
4. Check for defective Zener VR101, VR102 or VR103.
Yes
Is the 16.8kHz clock from WPIC correct?
No
1. Refer to the DC distribution (V2 – 2.775V) Test flowchart.
2. Refer to the RF WPIC flowchart.

Digital Analysis Test (Cont.)


A
Initialize the DSP. Use the Digital Diagnostic SW.
Did the unit pass the initialize DSP test?
No
Check for defective REDCAP2 (U301)
Yes
Load Setfiles to configure the chip selects
Did the unit pass the Load Setfiles test?
No
Check for defective REDCAP2 (U301)
Yes
Test the external SRAM (U302).
Did the unit pass the 512k 16 SRAM test?
No
Check for defective SDRAM (U302) or REDCAP2 (U301)
Yes
Test the Flash (U303)
Did the unit pass the flash test?
No
The Flash (U303) or the REDCAP2 (U301) are defective.
Yes
B

Digital Analysis Test (Cont.)


B
Test the DSP memory
Did the unit pass the DSP memory test?
No
The DSP inside the REDCAP2 (U301) is defective.
Yes
Test the backlight by turning it on
Note: This test will be performed by TetraCom SW application. Command: <BackL EN/DIS>
Did the backlight turn on?
No
Use the Diagnostic SW for 40 pin
Yes
Note: This test will be performed by TetraCom SW application. Command: <Leds EN/DIS>
Test the status LEDs
Did the diagnostic test pass?
No
Replace the Main Board
Yes
Did the status LEDs turn on?
No
Replace the Keypad and LCD
Yes
The Main Board successfully passed all tests

DC Distribution (V2_2.775V) Test

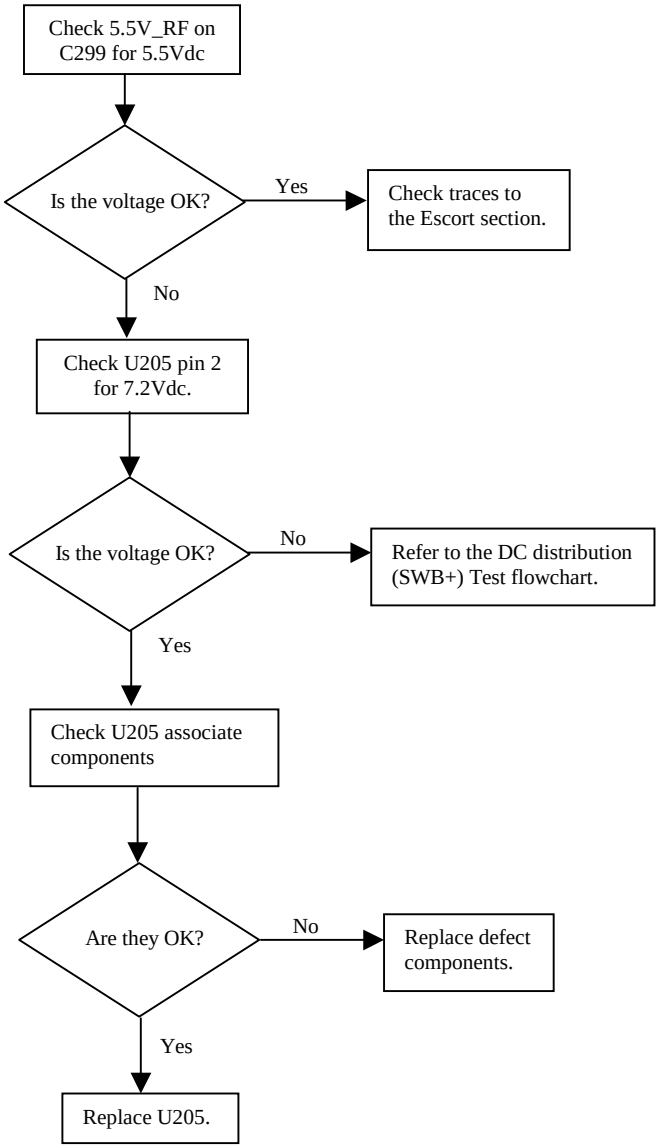
Use this test on a unit with the following symptoms: no power, no V2_2.775V, V1_2.775V, V3_2.775V, VREF1_2.775V, VREF2_2.775V.

Note: The following are the DC power distribution voltages with their correct values and appropriate location to check the voltages:

- Fused B+ (7.2Vdc) @ F200.
- Filt_3.3V (3.3Vdc) @ C282.
- V1_3V (3Vdc) @ C211.
- V2_2.775V (2.775Vdc) @ C210.
- V3_2.775V (2.775Vdc) @ C209, C258, C259.
- VREF1_2.775V (2.775Vdc) @ C285.
- VREF2_2.775V (2.775Vdc) @ C212.
- V4_2.775V (2.775Vdc) @ C225, C244, C247.
- 5V_RF (5Vdc) @ C251, C223.
- PWM1_1.8V (1.8Vdc) @ C224, C248.
- 5.5V_RF (5.5Vdc) @ C299

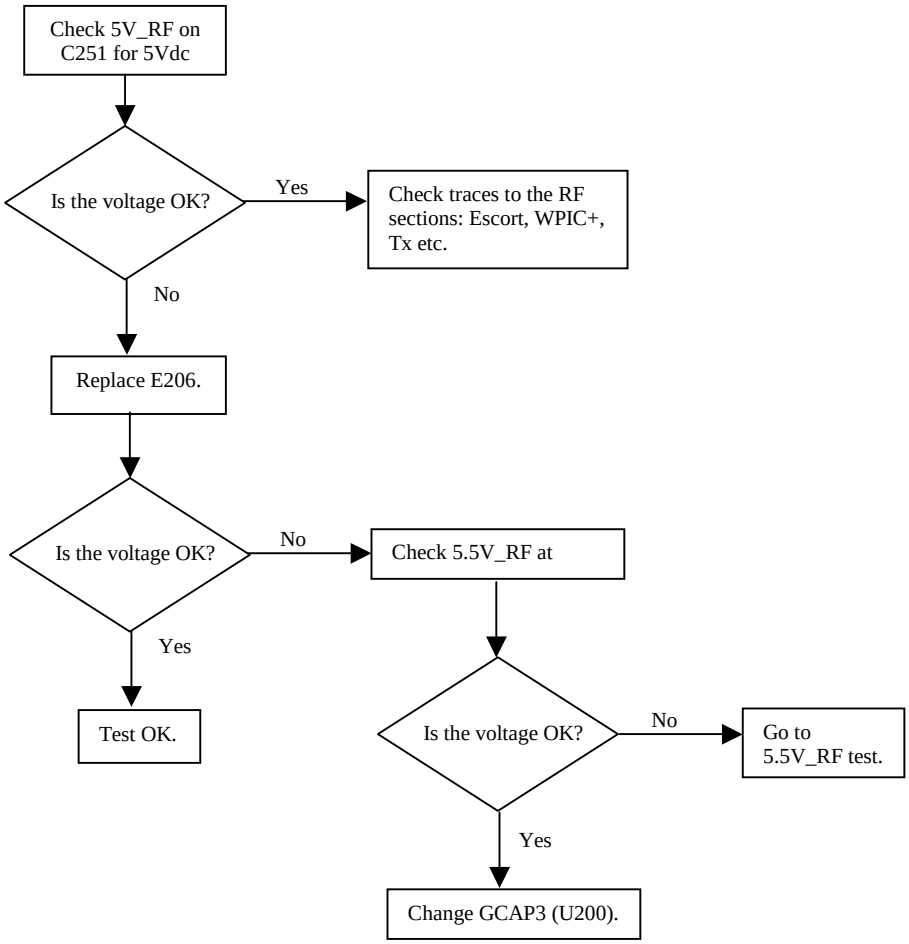
DC Distribution (5.5V_RF) Test

Use this test on a unit with the following symptoms: no 5.5V_RF.



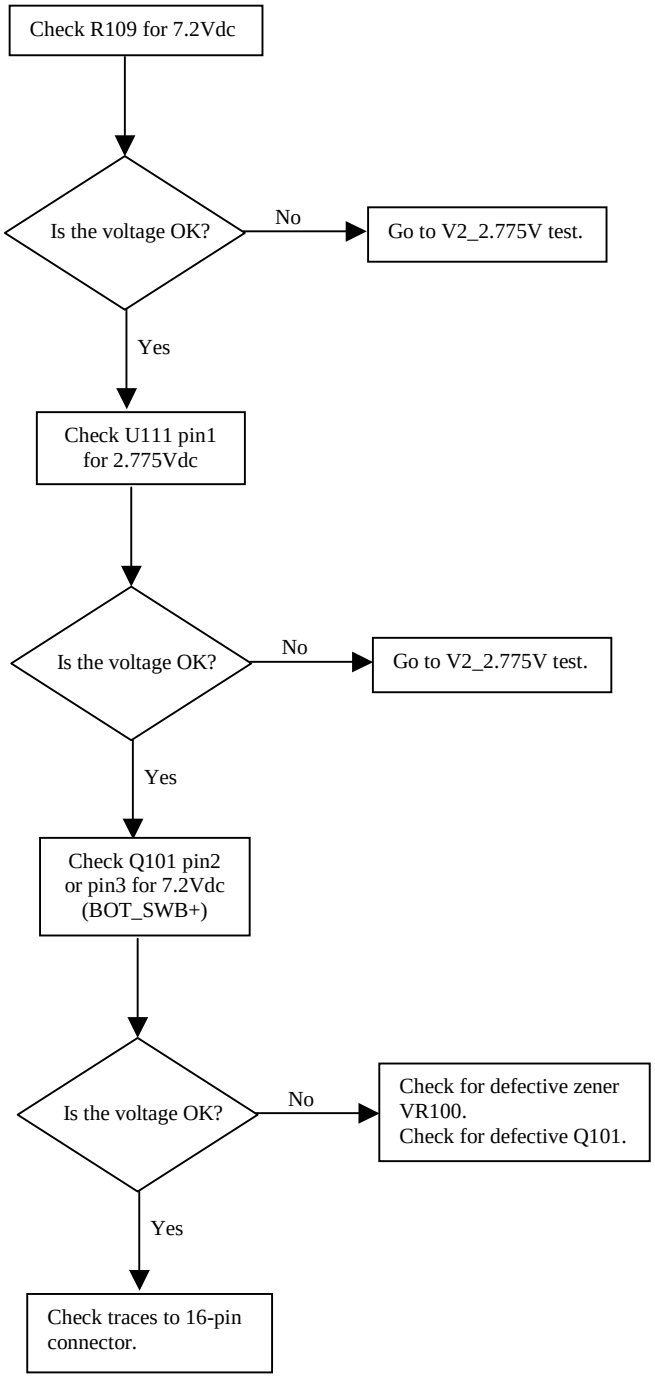
DC Distribution (5V_RF) Test

Use this test on a unit with the following symptoms: no 5V_RF.



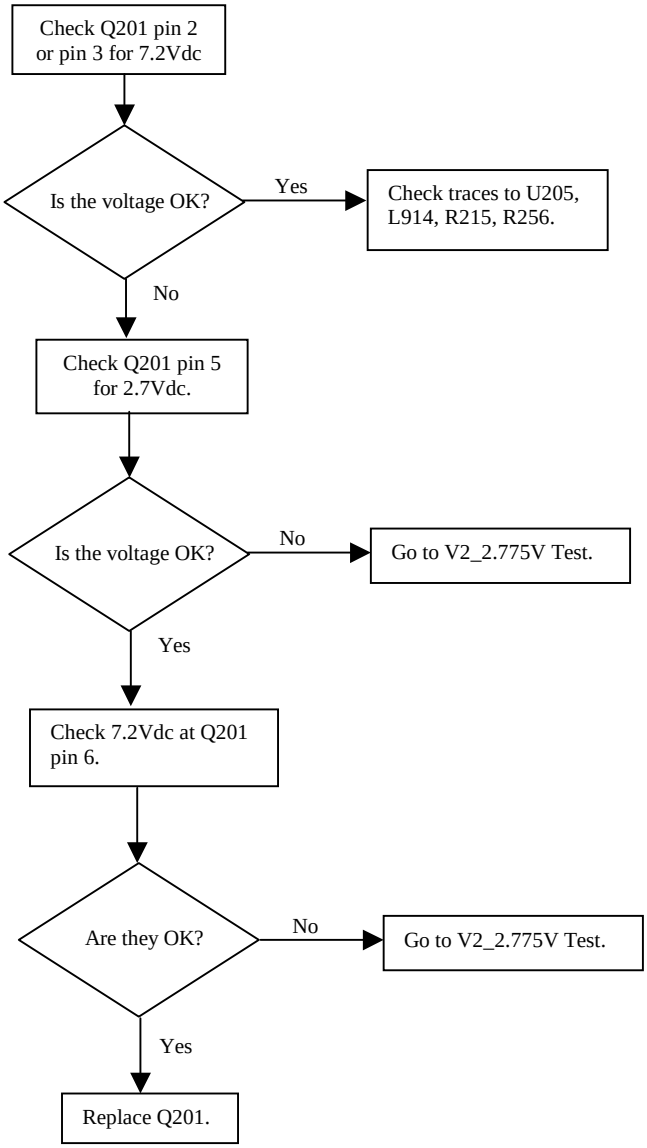
DC Distribution (BOT_SWB+) Test

Use this test on a unit with the following symptoms: no BOT_SWB+



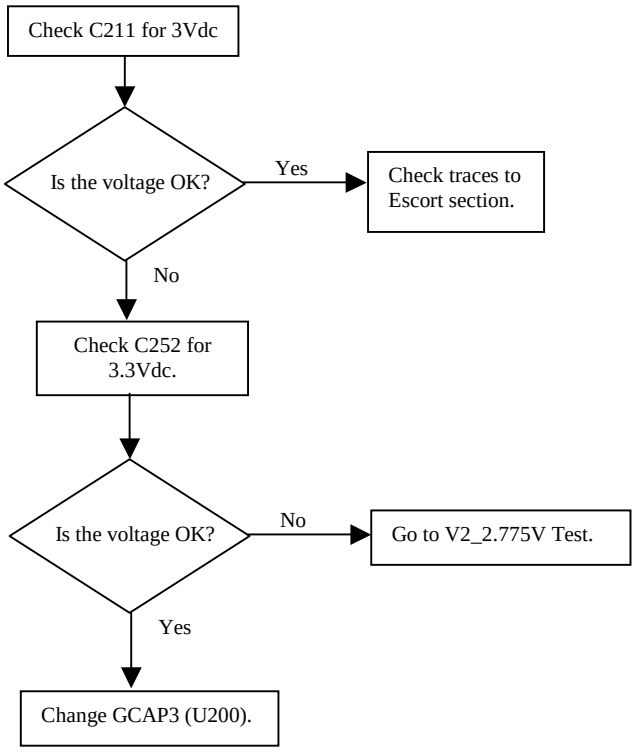
DC Distribution (SWB+ 7.2V) Test

Use this test on a unit with the following symptoms: no 7.2Vdc SWB+.

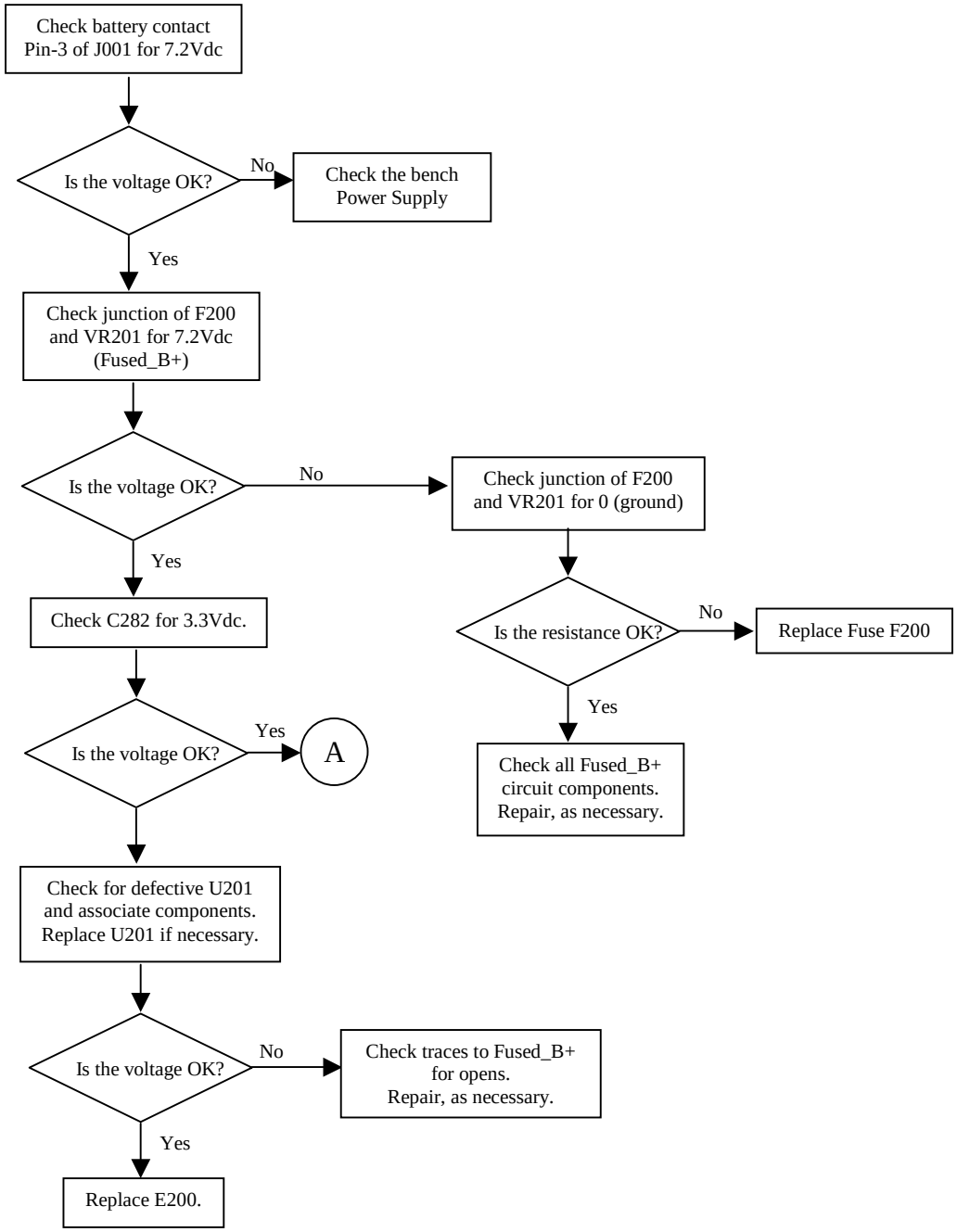


DC Distribution (V1_3V) Test

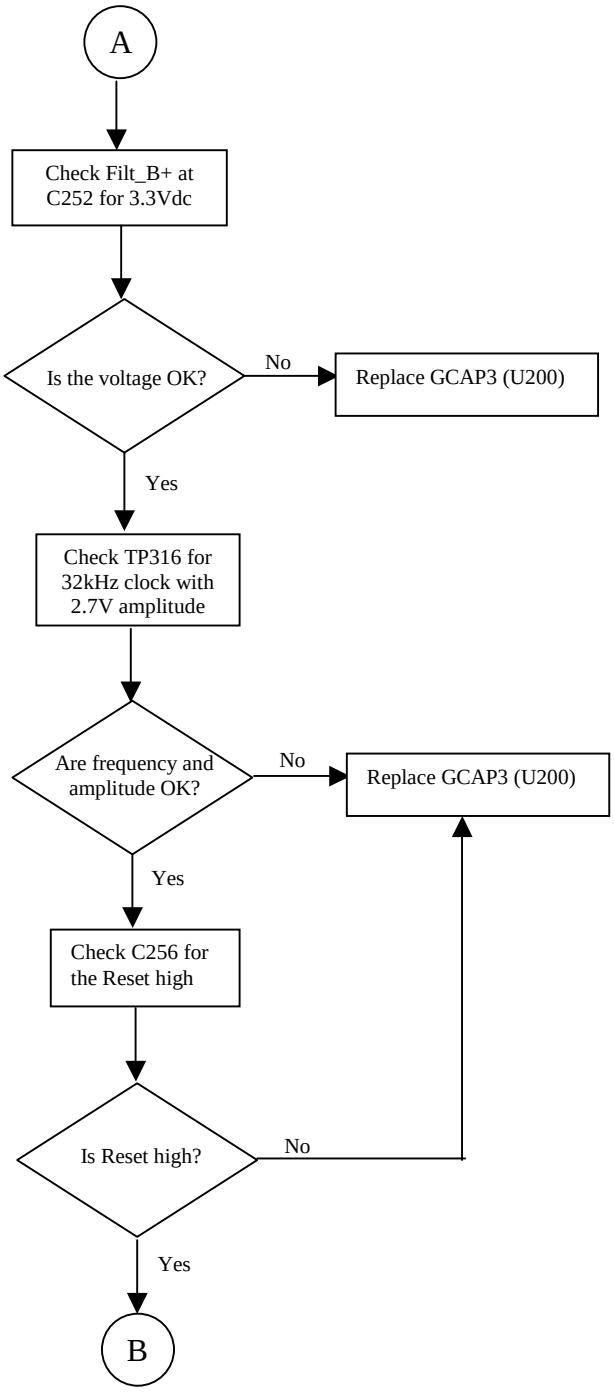
Use this test on a unit with the following symptoms: no V1_3V.



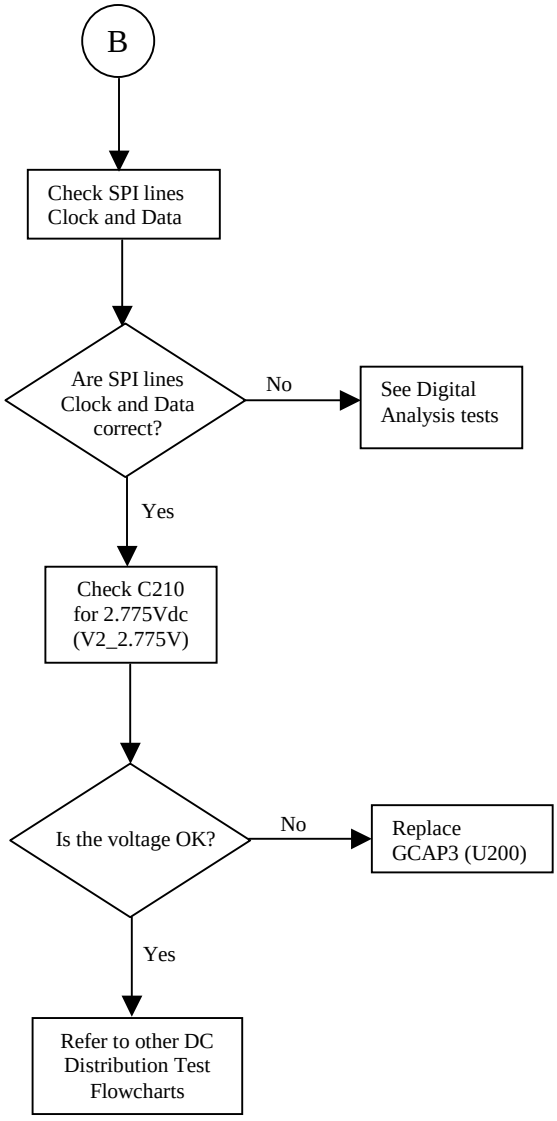
DC Distribution (V2_2.775V) Test



DC Distribution (V2_2.775V) Test (Cont.)

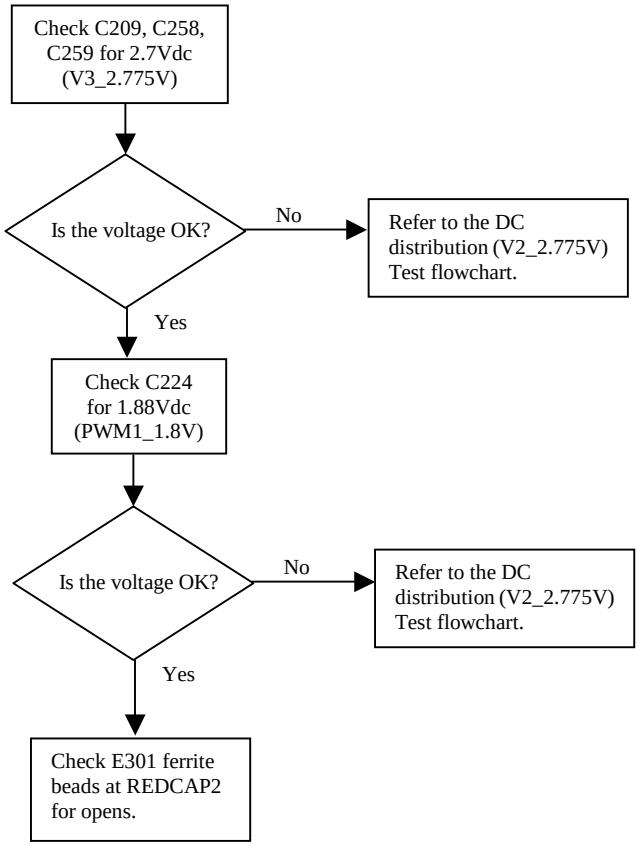


DC Distribution (V2_2.775V) Test (Cont.)



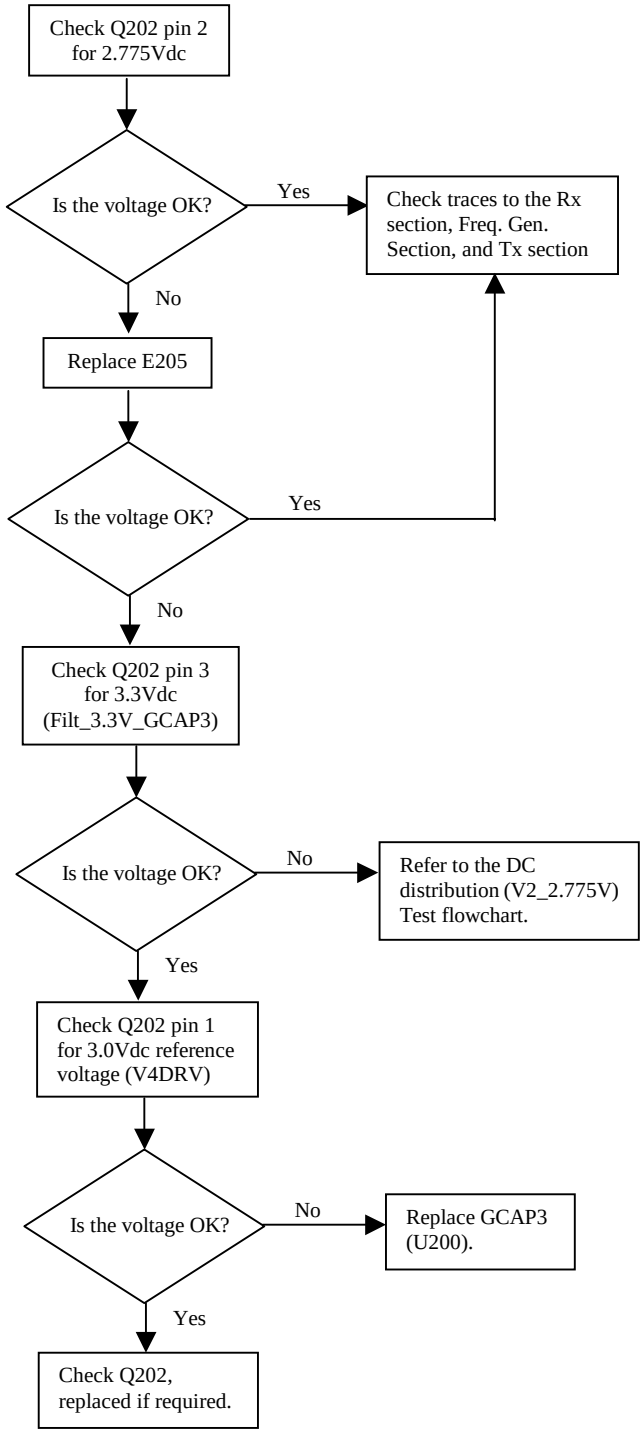
DC Distribution (V3_2.775V/PWM1_1.8V) Test

Use this test on a unit with the following symptoms: no V3_2.775V, no PWM1_1.8V.


Check C209, C258, C259 for 2.7Vdc (V3_2.775V)
Is the voltage OK?
No
Refer to the DC distribution (V2_2.775V) Test flowchart.
Yes
Check C224 for 1.88Vdc (PWM1_1.8V)
Is the voltage OK?
No
Refer to the DC distribution (V2_2.775V) Test flowchart.
Yes
Check E301 ferrite beads at REDCAP2 for opens.

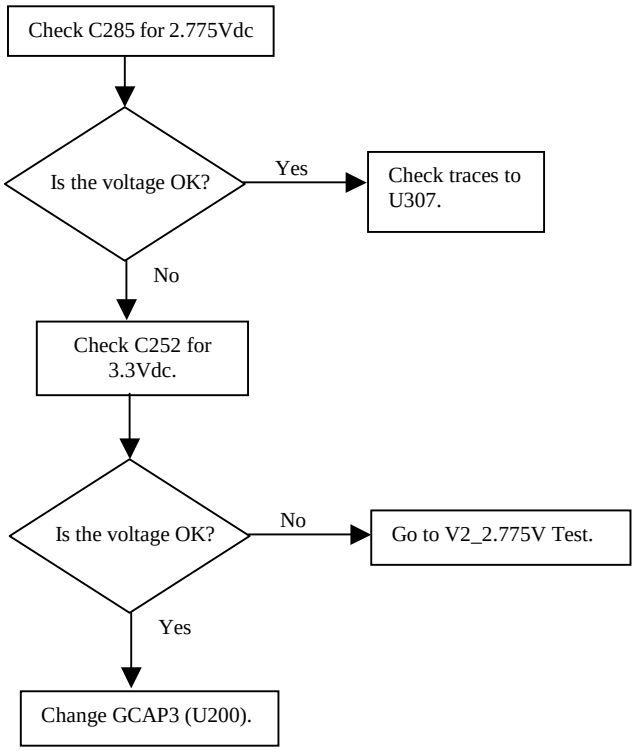
DC Distribution (V4_2.775V) Test

Use this test on a unit with the following symptoms: no V4_2.775V.



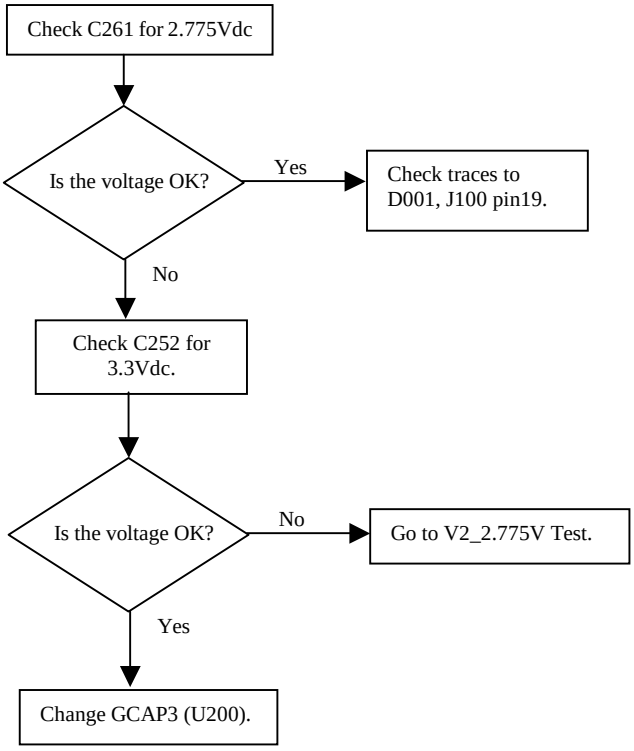
DC Distribution (VREF1_2.775V) Test

Use this test on a unit with the following symptoms: no VREF1_2.775V.



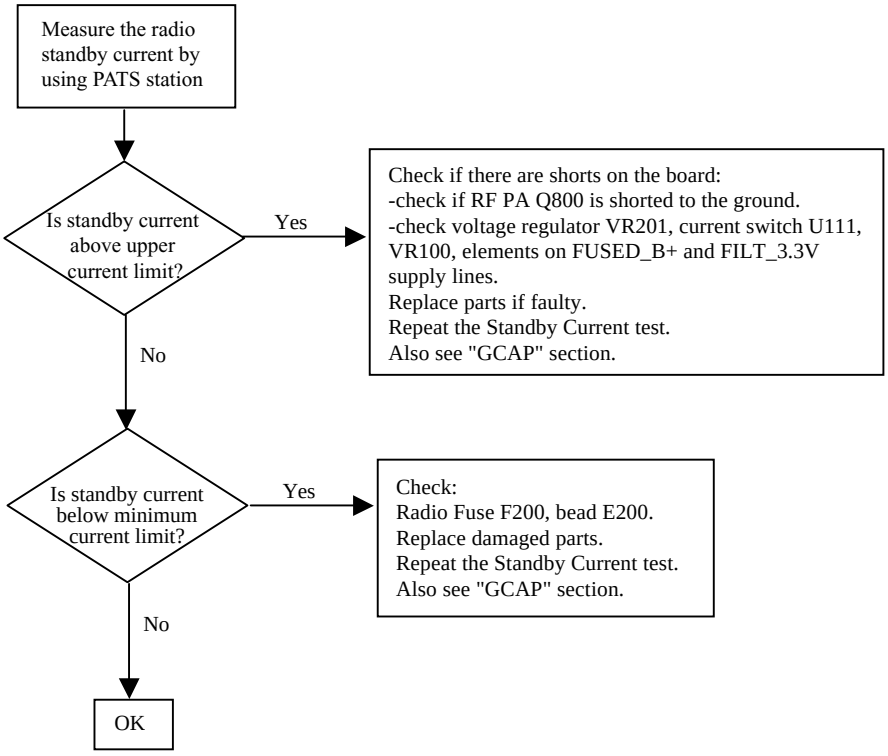
DC Distribution (VREF2_2.775V) Test

Use this test on a unit with the following symptoms: no VREF2_2.775V.

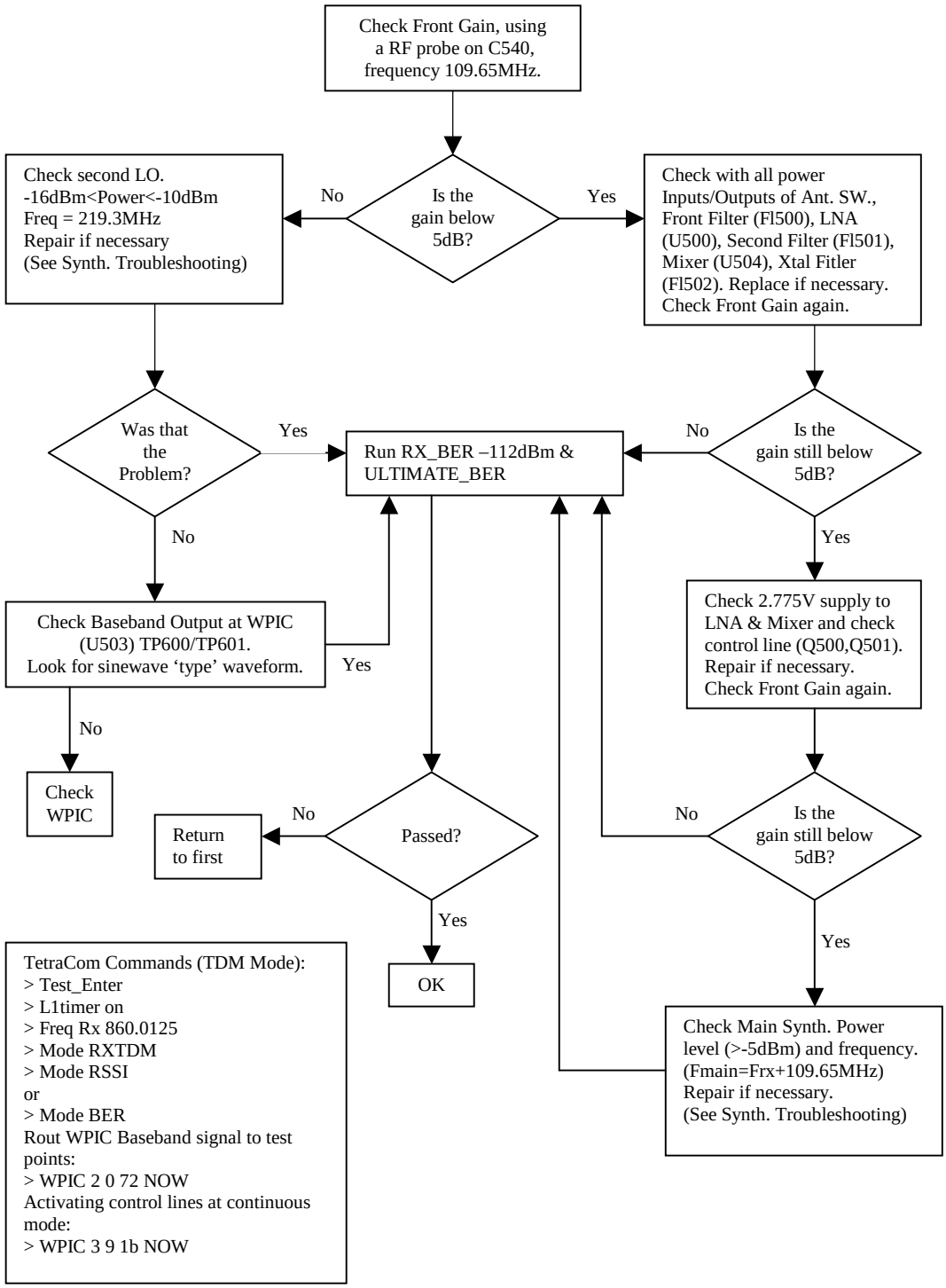


Standby Current Troubleshooting

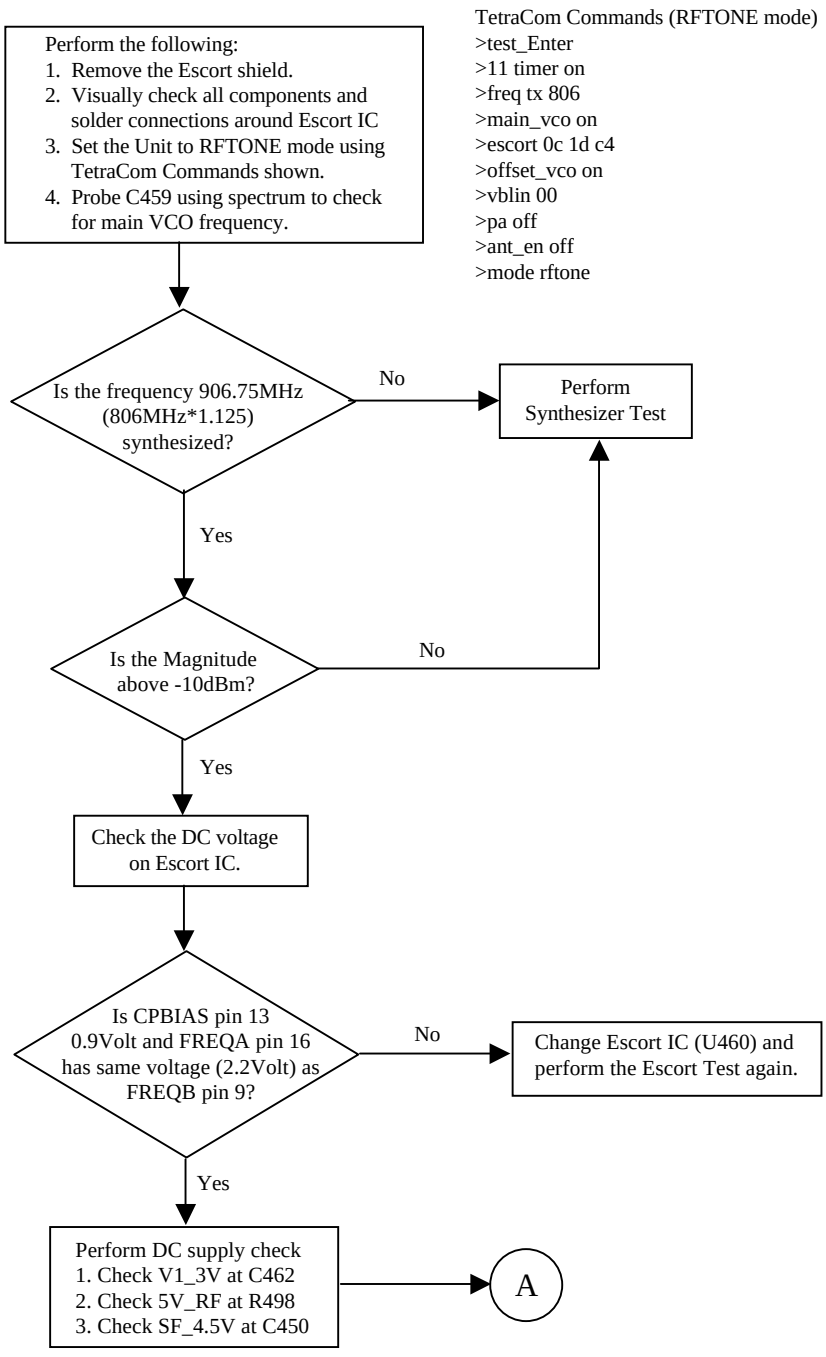
This test should be carried out only after the successful completion of the previous tests.


Measure the radio standby current by using PATS station
Is standby current above upper current limit?
Yes
Check if there are shorts on the board:
-check if RF PA Q800 is shorted to the ground.
-check voltage regulator VR201, current switch U111, VR100, elements on FUSED_B+ and FILT_3.3V supply lines.
Replace parts if faulty.
Repeat the Standby Current test.
Also see "GCAP" section.
No
Is standby current below minimum current limit?
Yes
Check:
Radio Fuse F200, bead E200.
Replace damaged parts.
Repeat the Standby Current test.
Also see "GCAP" section.
No
OK

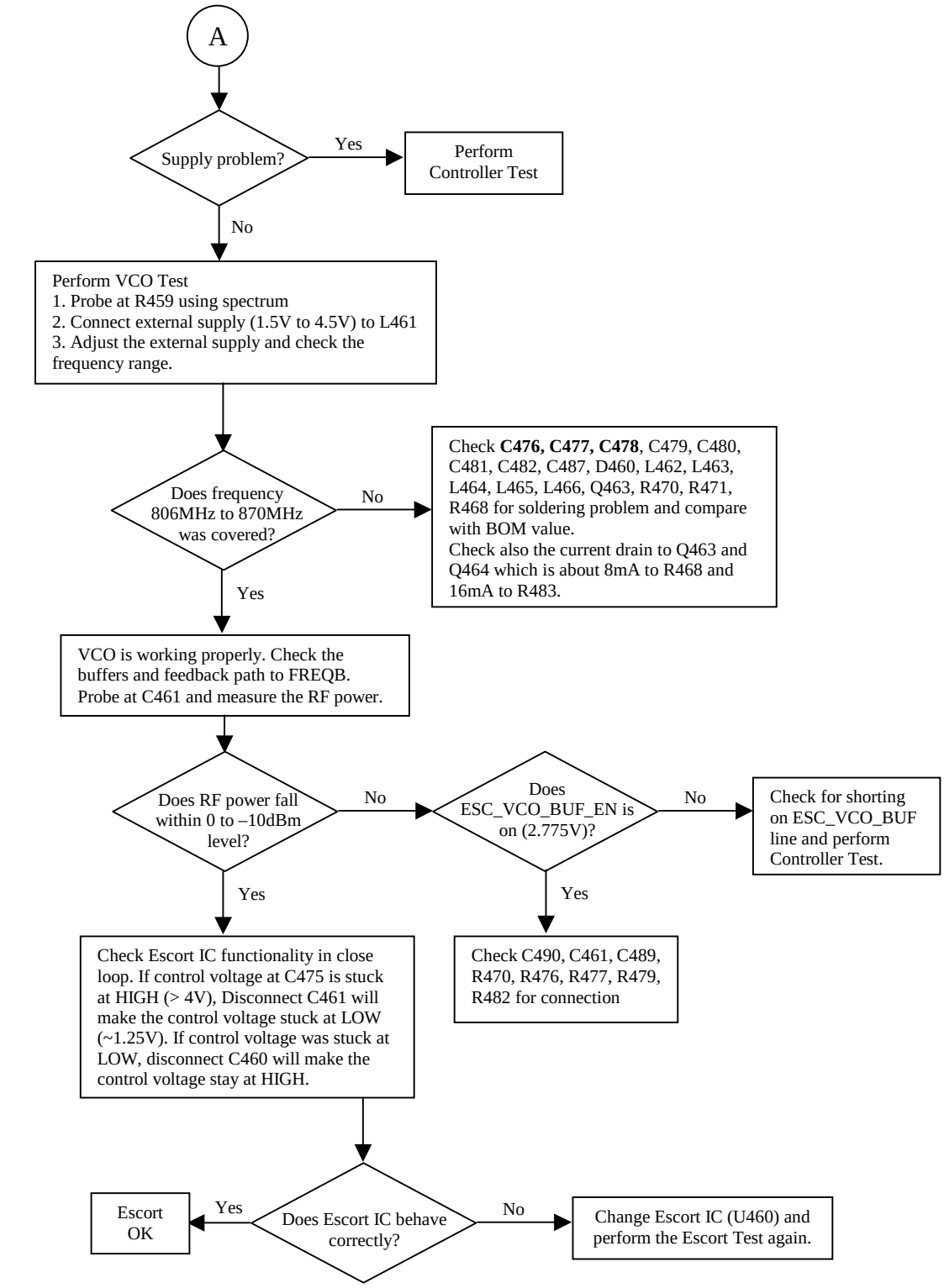
Receiver Troubleshooting



Escort Troubleshooting

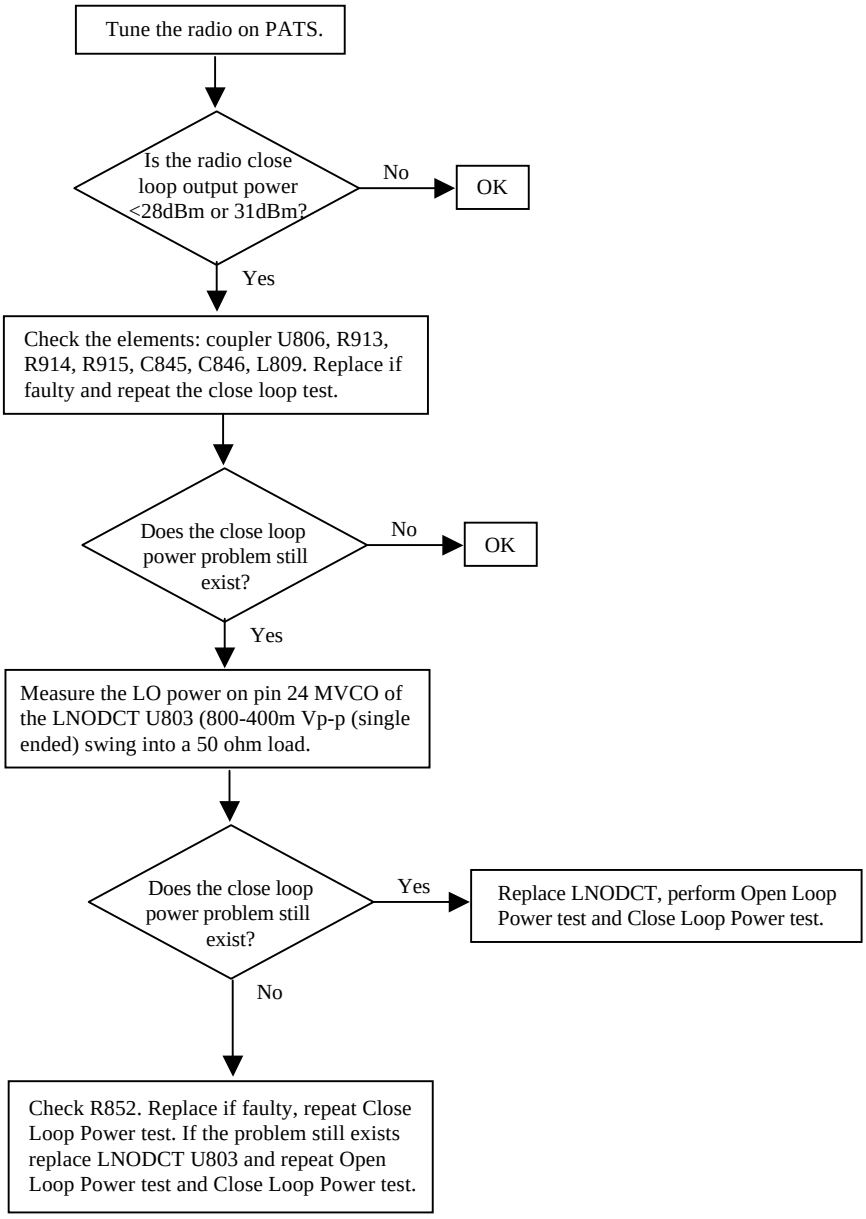

Perform the following:
1. Remove the Escort shield.
2. Visually check all components and solder connections around Escort IC
3. Set the Unit to RFTONE mode using TetraCom Commands shown.
4. Probe C459 using spectrum to check for main VCO frequency.
TetraCom Commands (RFTONE mode)
>test_Enter
>11 timer on
>freq tx 806
>main_vco on
>escort 0c 1d c4
>offset_vco on
>vblin 00
>pa off
>ant_en off
>mode rftone
Is the frequency 906.75MHz (806MHz*1.125) synthesized?
No
Perform Synthesizer Test
Yes
Is the Magnitude above -10dBm?
No
Yes
Check the DC voltage on Escort IC.
Is CPBIAS pin 13 0.9Volt and FREQA pin 16 has same voltage (2.2Volt) as FREQB pin 9?
No
Change Escort IC (U460) and perform the Escort Test again.
Yes
Perform DC supply check
1. Check V1_3V at C462
2. Check 5V_RF at R498
3. Check SF_4.5V at C450
A

Escort Troubleshooting (cont.)


A
Supply problem?
Yes
Perform Controller Test
No
Perform VCO Test
1. Probe at R459 using spectrum
2. Connect external supply (1.5V to 4.5V) to L461
3. Adjust the external supply and check the frequency range.
Does frequency 806MHz to 870MHz was covered?
No
Check **C476, C477, C478**, C479, C480, C481, C482, C487, D460, L462, L463, L464, L465, L466, Q463, R470, R471, R468 for soldering problem and compare with BOM value.
Check also the current drain to Q463 and Q464 which is about 8mA to R468 and 16mA to R483.
Yes
VCO is working properly. Check the buffers and feedback path to FREQB. Probe at C461 and measure the RF power.
Does RF power fall within 0 to –10dBm level?
No
Does ESC_VCO_BUF_EN is on (2.775V)?
No
Check for shorting on ESC_VCO_BUF line and perform Controller Test.
Yes
Yes
Check Escort IC functionality in close loop. If control voltage at C475 is stuck at HIGH (> 4V), Disconnect C461 will make the control voltage stuck at LOW (~1.25V). If control voltage was stuck at LOW, disconnect C460 will make the control voltage stay at HIGH.
Check C490, C461, C489, R470, R476, R477, R479, R482 for connection
Does Escort IC behave correctly?
Yes
Escort OK
No
Change Escort IC (U460) and perform the Escort Test again.

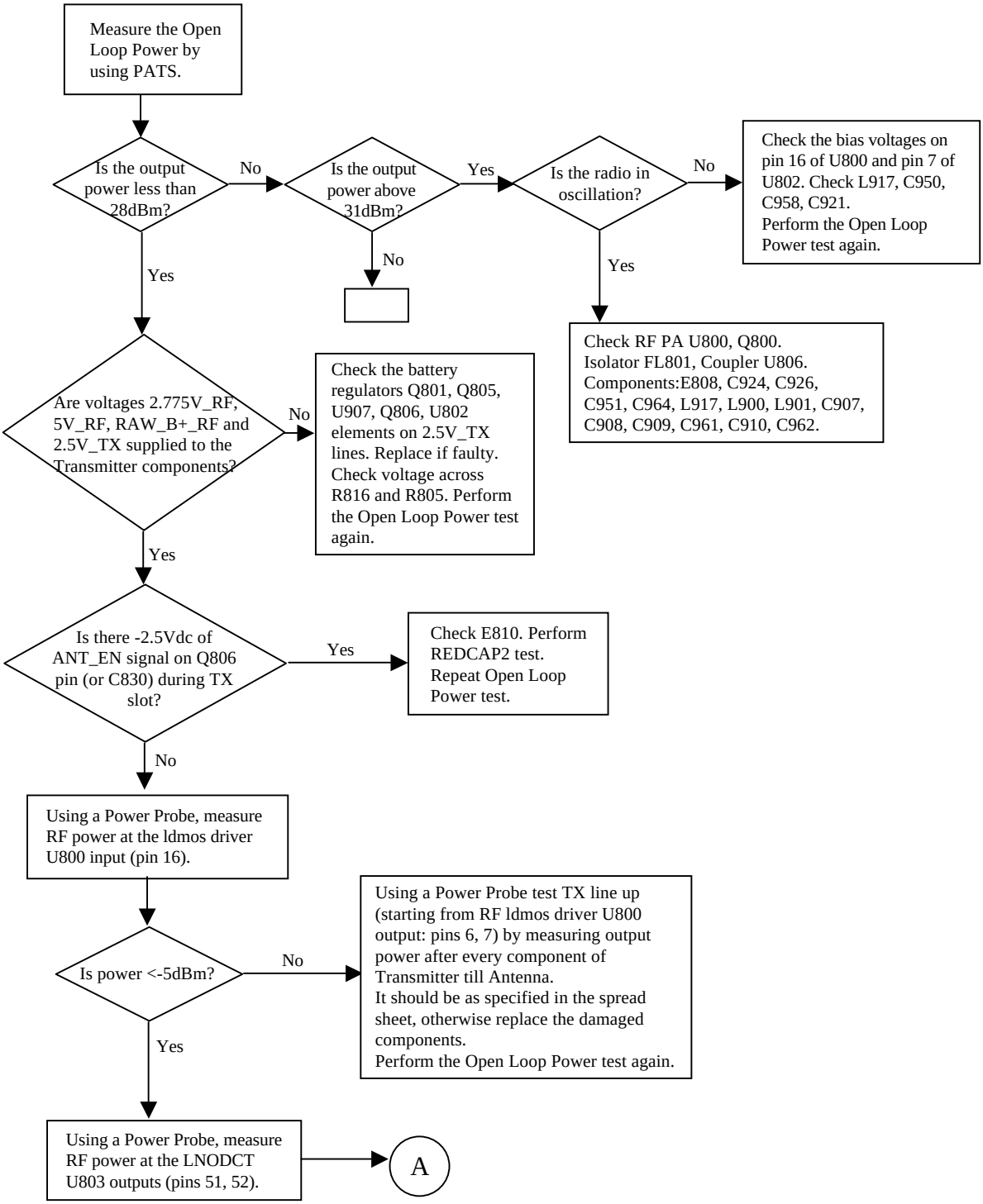
Closed Loop Power Test

This test should be carried out only after the successful completion of the previous tests.

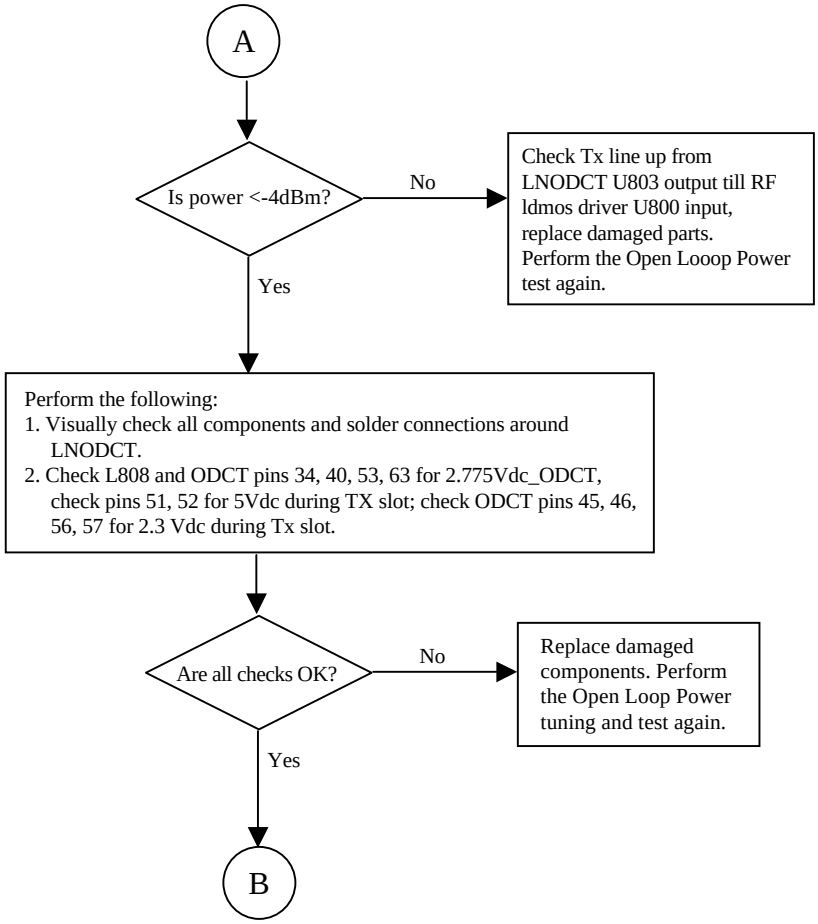

Tune the radio on PATS.
Is the radio close loop output power <28dBm or 31dBm?
No
OK
Yes
Check the elements: coupler U806, R913, R914, R915, C845, C846, L809. Replace if faulty and repeat the close loop test.
Does the close loop power problem still exist?
No
OK
Yes
Measure the LO power on pin 24 MVCO of the LNODCT U803 (800-400m Vp-p (single ended) swing into a 50 ohm load.
Does the close loop power problem still exist?
Yes
Replace LNODCT, perform Open Loop Power test and Close Loop Power test.
No
Check R852. Replace if faulty, repeat Close Loop Power test. If the problem still exists replace LNODCT U803 and repeat Open Loop Power test and Close Loop Power test.

Open Loop Power Test

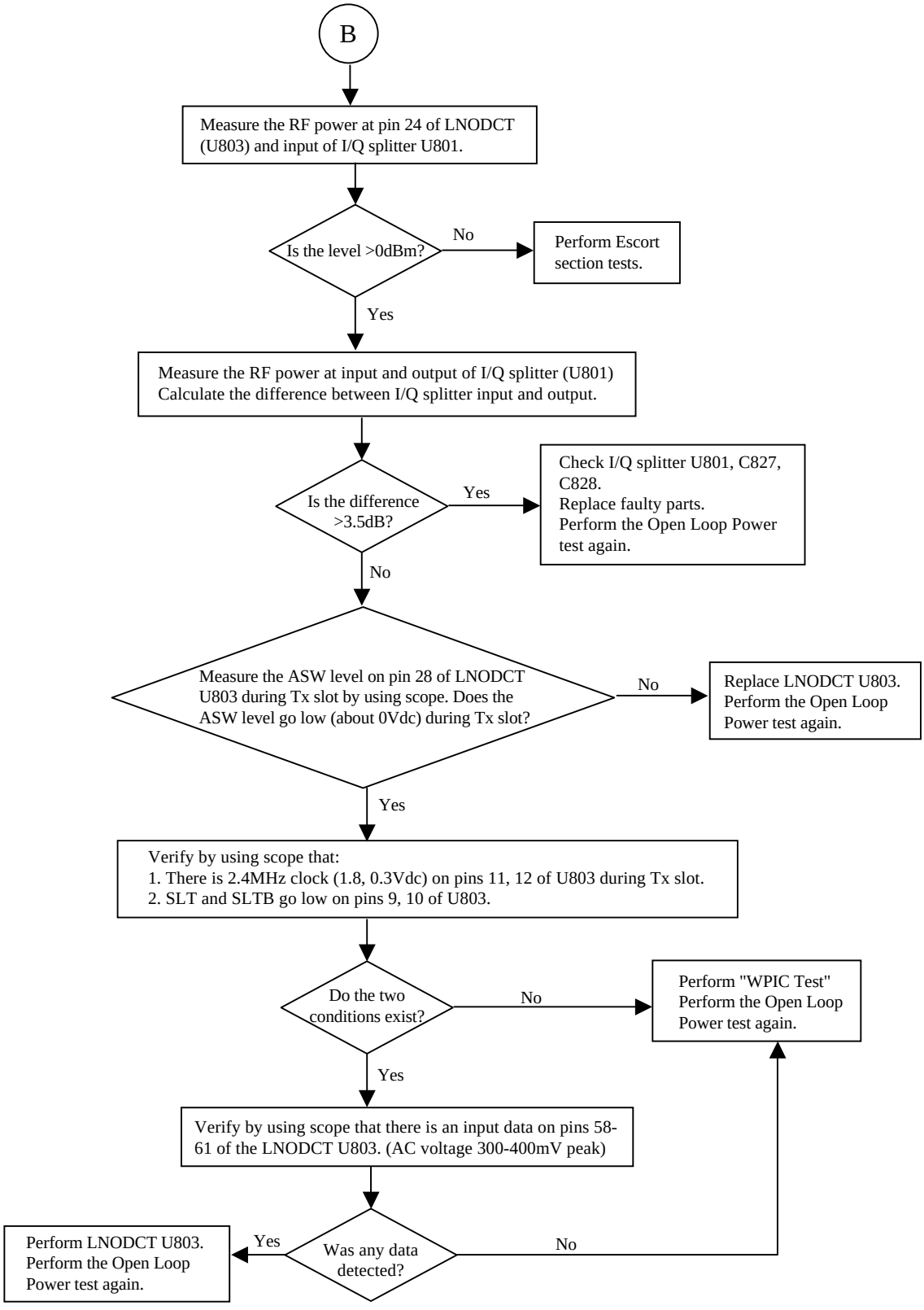
This test should be carried out only after the successful completion of the previous tests.


Measure the Open Loop Power by using PATS.
Is the output power less than 28dBm?
No
Is the output power above 31dBm?
Yes
Is the radio in oscillation?
No
Check the bias voltages on pin 16 of U800 and pin 7 of U802. Check L917, C950, C958, C921.
Perform the Open Loop Power test again.
Yes
No
Yes
Check RF PA U800, Q800.
Isolator FL801, Coupler U806.
Components:E808, C924, C926, C951, C964, L917, L900, L901, C907, C908, C909, C961, C910, C962.
Are voltages 2.775V_RF, 5V_RF, RAW_B+_RF and 2.5V_TX supplied to the Transmitter components?
No
Check the battery regulators Q801, Q805, U907, Q806, U802 elements on 2.5V_TX lines. Replace if faulty. Check voltage across R816 and R805. Perform the Open Loop Power test again.
Yes
Is there -2.5Vdc of ANT_EN signal on Q806 pin (or C830) during TX slot?
Yes
Check E810. Perform REDCAP2 test.
Repeat Open Loop Power test.
No
Using a Power Probe, measure RF power at the ldmos driver U800 input (pin 16).
Is power <-5dBm?
No
Using a Power Probe test TX line up (starting from RF ldmos driver U800 output: pins 6, 7) by measuring output power after every component of Transmitter till Antenna.
It should be as specified in the spread sheet, otherwise replace the damaged components.
Perform the Open Loop Power test again.
Yes
Using a Power Probe, measure RF power at the LNODCT U803 outputs (pins 51, 52).
A

Open Loop Power Test (Cont.)

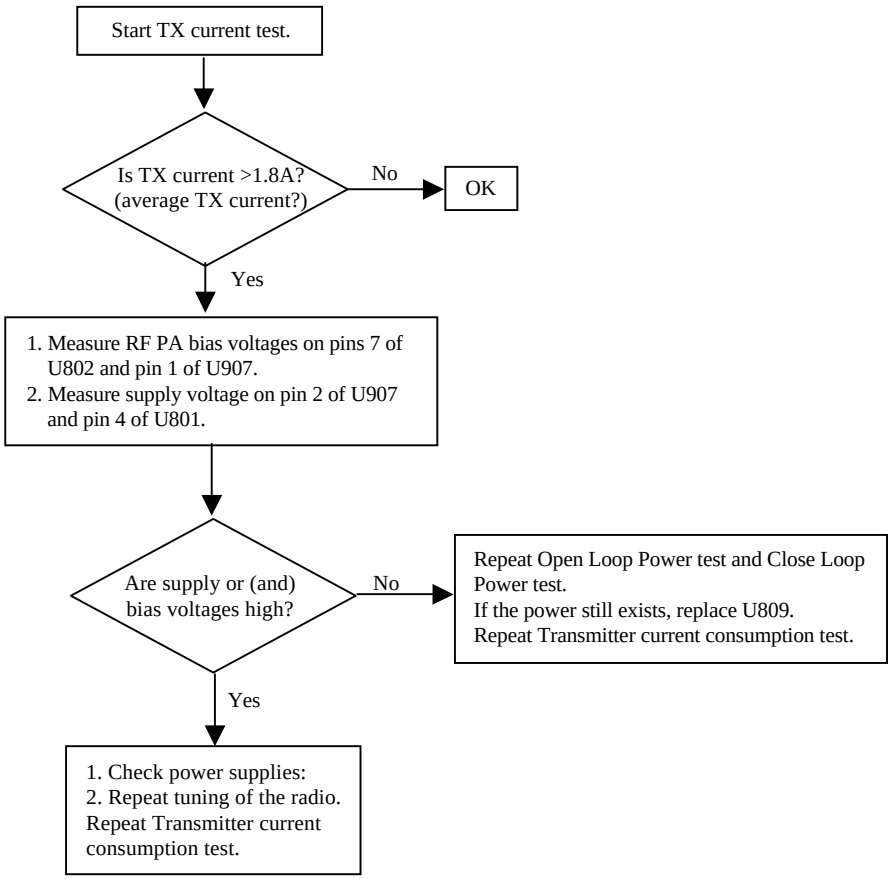

A
Is power <-4dBm?
No
Check Tx line up from LNODCT U803 output till RF ldmos driver U800 input, replace damaged parts. Perform the Open Looop Power test again.
Yes
Perform the following:
1. Visually check all components and solder connections around LNODCT.
2. Check L808 and ODCT pins 34, 40, 53, 63 for 2.775Vdc_ODCT, check pins 51, 52 for 5Vdc during TX slot; check ODCT pins 45, 46, 56, 57 for 2.3 Vdc during Tx slot.
Are all checks OK?
No
Replace damaged components. Perform the Open Loop Power tuning and test again.
Yes
B

Open Loop Power Test (Cont.)

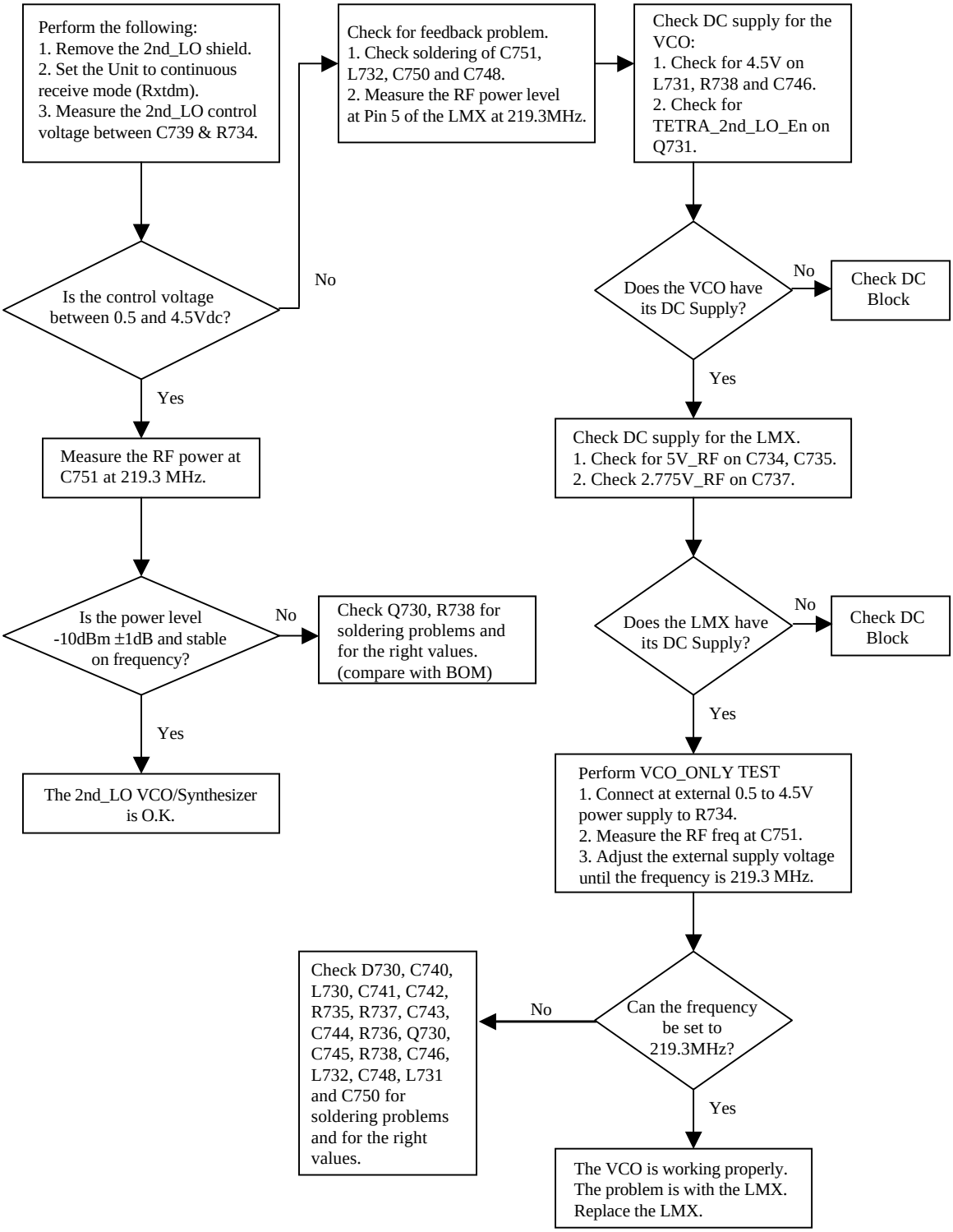

B
Measure the RF power at pin 24 of LNODCT (U803) and input of I/Q splitter U801.
Is the level >0dBm?
No
Perform Escort section tests.
Yes
Measure the RF power at input and output of I/Q splitter (U801) Calculate the difference between I/Q splitter input and output.
Is the difference >3.5dB?
Yes
Check I/Q splitter U801, C827, C828. Replace faulty parts. Perform the Open Loop Power test again.
No
Measure the ASW level on pin 28 of LNODCT U803 during Tx slot by using scope. Does the ASW level go low (about 0Vdc) during Tx slot?
No
Replace LNODCT U803. Perform the Open Loop Power test again.
Yes
Verify by using scope that:
1. There is 2.4MHz clock (1.8, 0.3Vdc) on pins 11, 12 of U803 during Tx slot.
2. SLT and SLTB go low on pins 9, 10 of U803.
Do the two conditions exist?
No
Perform "WPIC Test" Perform the Open Loop Power test again.
Yes
Verify by using scope that there is an input data on pins 58-61 of the LNODCT U803. (AC voltage 300-400mV peak)
Was any data detected?
Yes
Perform LNODCT U803. Perform the Open Loop Power test again.
No

Transmitter Current Consumption Test

This test should be carried out only after the successful completion of the previous tests.

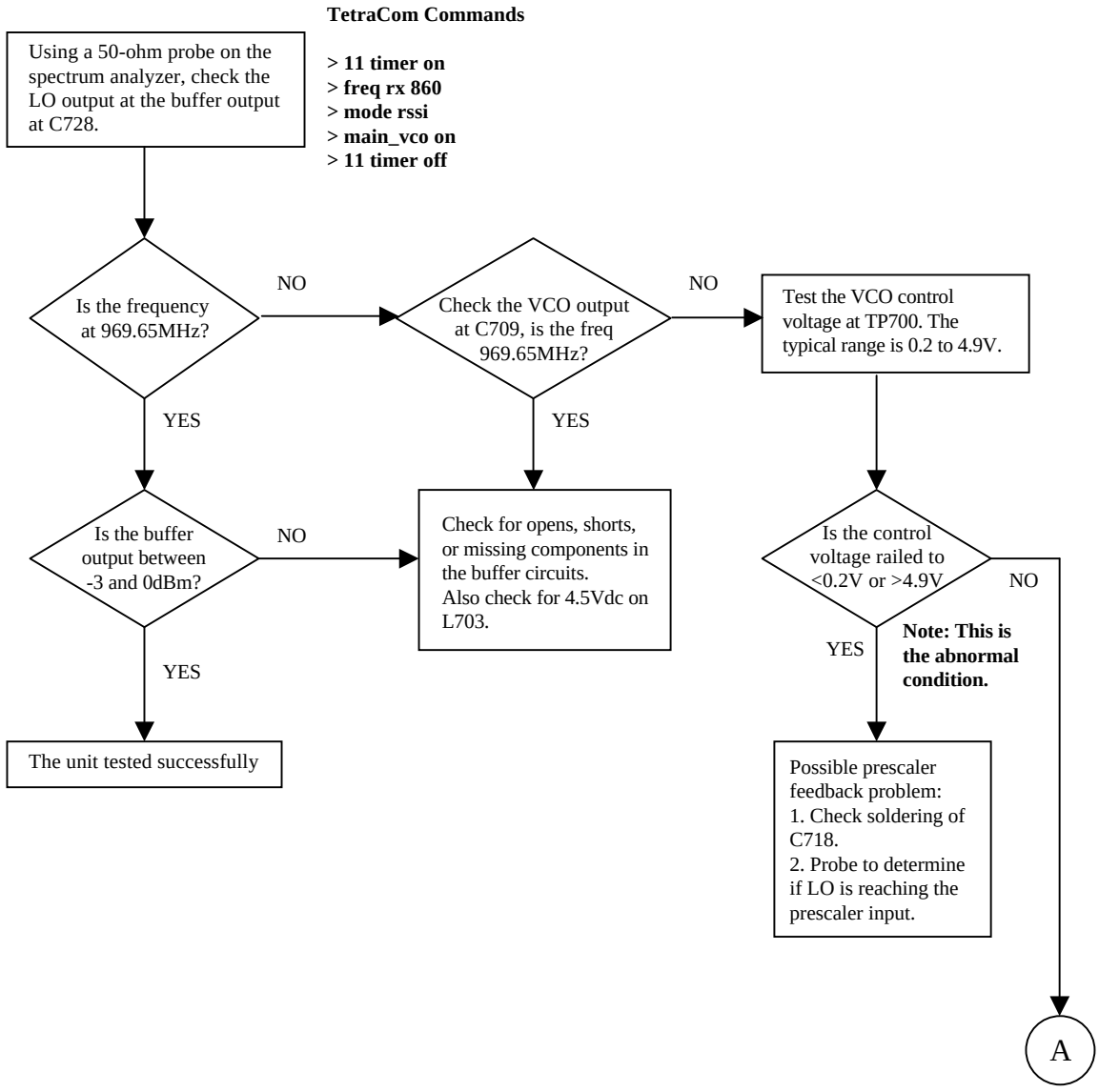

Start TX current test.
Is TX current >1.8A?
(average TX current?)
No
OK
Yes
1. Measure RF PA bias voltages on pins 7 of U802 and pin 1 of U907.
2. Measure supply voltage on pin 2 of U907 and pin 4 of U801.
Are supply or (and) bias voltages high?
No
Repeat Open Loop Power test and Close Loop Power test.
If the power still exists, replace U809.
Repeat Transmitter current consumption test.
Yes
1. Check power supplies:
2. Repeat tuning of the radio.
Repeat Transmitter current consumption test.

2nd LO Troubleshooting

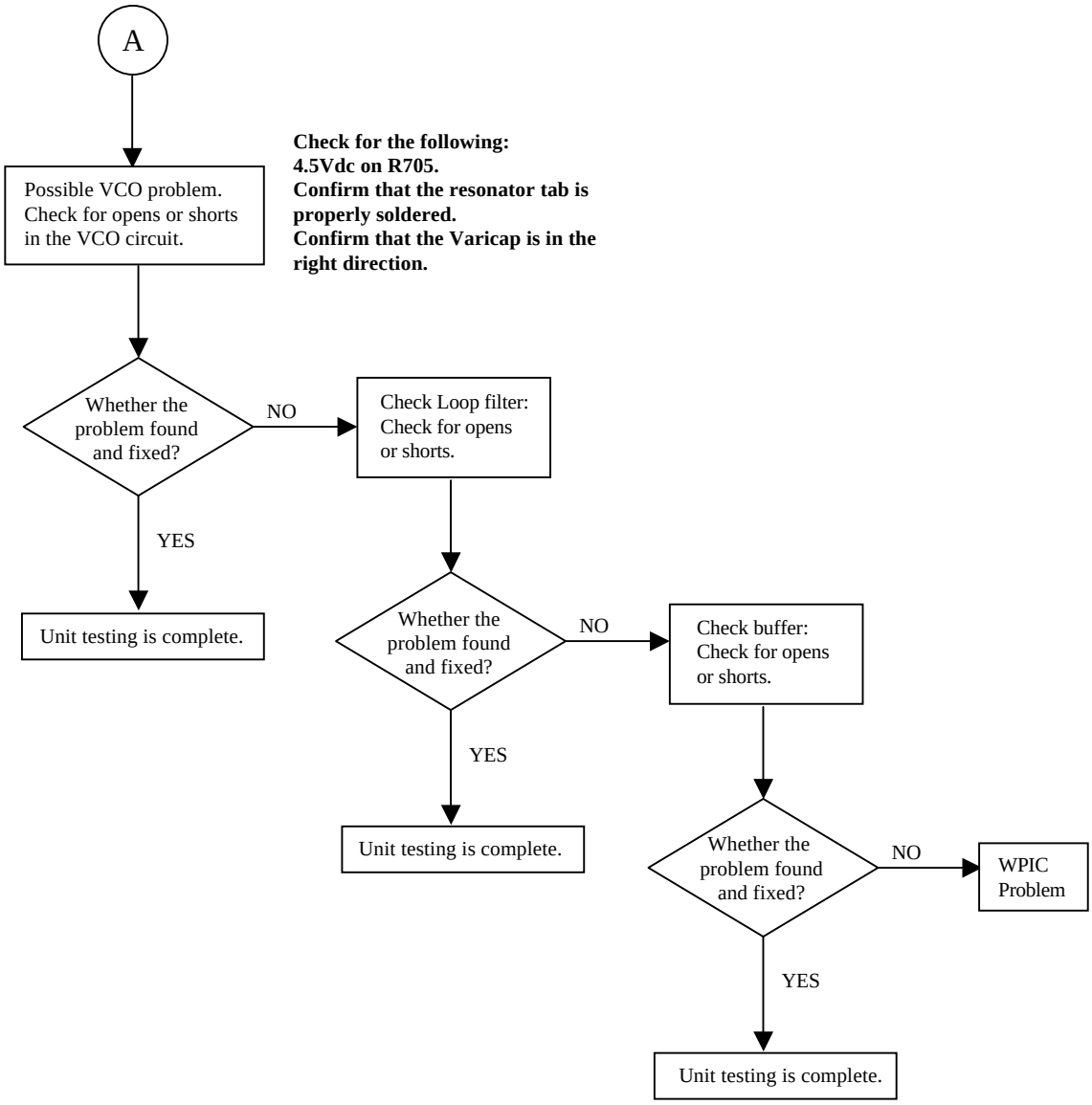

Perform the following:
1. Remove the 2nd_LO shield.
2. Set the Unit to continuous receive mode (Rxtdm).
3. Measure the 2nd_LO control voltage between C739 & R734.
Is the control voltage between 0.5 and 4.5Vdc?
No
Yes
Check for feedback problem.
1. Check soldering of C751, L732, C750 and C748.
2. Measure the RF power level at Pin 5 of the LMX at 219.3MHz.
Measure the RF power at C751 at 219.3 MHz.
Is the power level -10dBm ±1dB and stable on frequency?
No
Check Q730, R738 for soldering problems and for the right values. (compare with BOM)
Yes
The 2nd_LO VCO/Synthesizer is O.K.
Check DC supply for the VCO:
1. Check for 4.5V on L731, R738 and C746.
2. Check for TETRA_2nd_LO_En on Q731.
Does the VCO have its DC Supply?
No
Check DC Block
Yes
Check DC supply for the LMX.
1. Check for 5V_RF on C734, C735.
2. Check 2.775V_RF on C737.
Does the LMX have its DC Supply?
No
Check DC Block
Yes
Perform VCO_ONLY TEST
1. Connect at external 0.5 to 4.5V power supply to R734.
2. Measure the RF freq at C751.
3. Adjust the external supply voltage until the frequency is 219.3 MHz.
Can the frequency be set to 219.3MHz?
No
Check D730, C740, L730, C741, C742, R735, R737, C743, C744, R736, Q730, C745, R738, C746, L732, C748, L731 and C750 for soldering problems and for the right values.
Yes
The VCO is working properly.
The problem is with the LMX.
Replace the LMX.

Synthesizer & VCO Troubleshooting

Use this test on a unit with the following symptom: no Tx or Rx.


TetraCom Commands
> 11 timer on
> freq rx 860
> mode rssi
> main_vco on
> 11 timer off
Using a 50-ohm probe on the spectrum analyzer, check the LO output at the buffer output at C728.
Is the frequency at 969.65MHz?
NO
Check the VCO output at C709, is the freq 969.65MHz?
NO
Test the VCO control voltage at TP700. The typical range is 0.2 to 4.9V.
YES
YES
Is the buffer output between -3 and 0dBm?
NO
Check for opens, shorts, or missing components in the buffer circuits.
Also check for 4.5Vdc on L703.
Is the control voltage railed to <0.2V or >4.9V
NO
YES
Note: This is the abnormal condition.
YES
The unit tested successfully
Possible prescaler feedback problem:
1. Check soldering of C718.
2. Probe to determine if LO is reaching the prescaler input.
A

Synthesizer & VCO Troubleshooting (Cont.)


A
Possible VCO problem. Check for opens or shorts in the VCO circuit.
Check for the following:
4.5Vdc on R705.
Confirm that the resonator tab is properly soldered.
Confirm that the Varicap is in the right direction.
Whether the problem found and fixed?
NO
Check Loop filter: Check for opens or shorts.
YES
Unit testing is complete.
Whether the problem found and fixed?
NO
Check buffer: Check for opens or shorts.
YES
Unit testing is complete.
Whether the problem found and fixed?
NO
WPIC Problem
YES
Unit testing is complete.

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CHAPTER 5
PROGRAMMING THE RADIO

Before Using the Customer Programming Software (CPS)

Before you begin programming, ensure the following:

1. Install the Customer Programming Software (CPS), FVN5051A, in your computer.
2. Use a fully charged radio battery.
3. With the radio initially turned off, properly place radio into Programming Stand, PMLN4510.
4. Connect the Programming/Data cable, FLN9636, according to Setup for Radio Programming Figure 5-1. This cable has a switch with two positions “Data” and “Flash”. Set the switch to “Flash” to enable programming.
5. Turn radio on by rotating the On/Off knob clockwise. Verify that no display appears on the radio LCD screen.

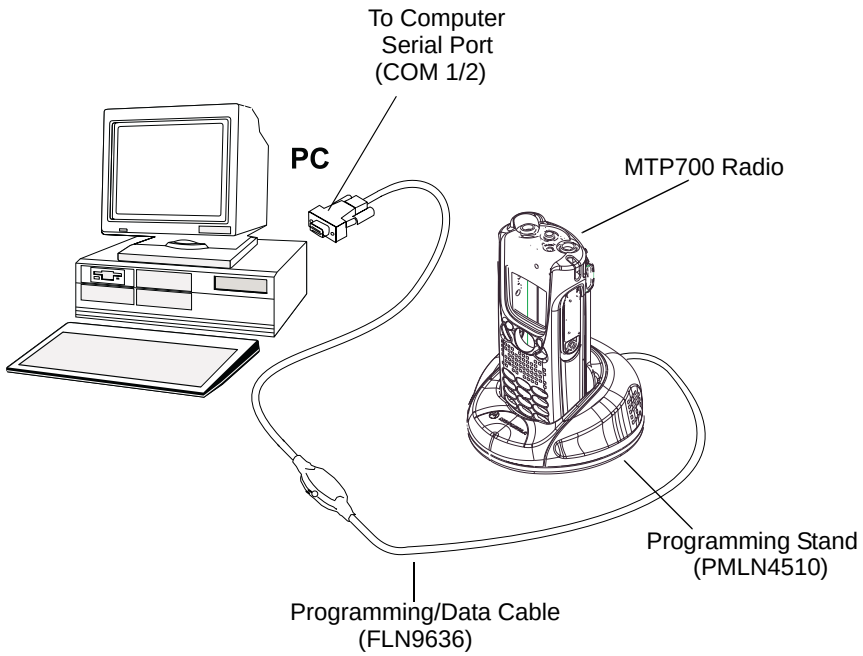
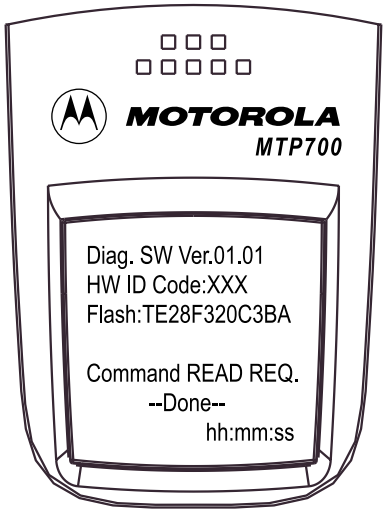


Figure 5-1 Setup for Radio Programming.

Reading Codeplug

1. Run the Customer Programming Software (CPS) on your computer.
2. Click the Toolbar “Read Phone” icon. *Refer to the CPS Application Window Screen in the CPS User Guide, Publication No. 68P02956C20.* The setup enters an initialization process that takes about 20 seconds. After that, a reading process starts.

Note: While reading is in progress, the radio screen displays the following data:



A progress bar appears on the computer screen. After the reading process is finished, the radio Codeplug screen appears.

Programming Codeplug

1. On the menu bar, click “File”, “Open”.
2. Browse for the required Codeplug file and open the file (.dbf extension).
3. The Codeplug window appears on the screen.
4. Click the Toolbar “Write Phone” icon.

Note: The Codeplug is now being written into the radio. A progress bar is displayed on the computer screen showing the writing status.
After a successful writing, the message “The Operation Was Successful” appears on the computer screen.

5. Press the “OK” button.

Programming Frequency

Carry out the following steps if you need to add or change the radio frequencies.

Note: Save your radio factory frequencies before you start programming by using “File”, “Save As”. Give the file a proper name, eg “default.dbf”.

1. In the “Codeplug Tree” select “System Parameters”.

- Click on “Frequency List”.
- Click on “List2”.
- At the top of list, enter the three frequencies which you have selected (the following frequencies are for example only):

  Rx 420.0125MHz (IFR 800)

  Rx 425.0125MHz (IFR 1000)

  Rx 429.9875MHz (IFR 1199)

2. Click the Toolbar “Write Phone” icon.
3. Disconnect the radio from the programming kit.

Note: The new programmed frequencies of the radio are now available to be tested with the IFR or for any other use.

“List2” frequencies are saved on the codeplug and may only be accessed in Test Page mode. To go into Test Page (feature must be turned on in CPS i.e. “User Personal Data\Ergonomic Parameters\Feature Flags\Test Page” checked on), perform steps **4** thru **7** by pressing the radio keys sequentially (less then a second between every consecutive press):

4. *Press the “Side Button 2” key.*
5. *Press the “1” key, and “Menu” key.*
6. *Press the “2” key, and “Menu” key.*
7. *Press the “3” key.*

Hereafter, there is no need for quick sequence of pressing the radio keys.

8. Scroll through the list and select “Cell Lists”.
9. Press the “OK” key.
10. Scroll through the list. Select “List2”.
11. Press the “OK” key.
12. View the frequencies using the arrow navigation keys.

Restoring Factory Frequencies of the Radio

To restore the factory frequencies of the radio, perform the following steps:

1. After testing your radio on the IFR, connect the setup as shown in Figure 5-1.
2. Run the CPS software on your PC.
3. In the menu bar click “Tools”, “Copy Wizard”.

- Click on “Read from a file”.
- Click on “Browse”.
- Open the file which contains the default factory frequencies (ie “default.dbf” file which you saved in “Programming Factory” section earlier).
- Click on “Next”.
- Click on “Select All”.
- Click on “Next”.
- Click on “Write”.
- Click on “Done”.

Note: Click on toolbar “Read Phone” to check whether the same factory frequencies were entered into the radio before programming.

Programming Firmware

Note: Login as “Administrator” to perform this task.

1. On the menu bar click “Tools”, “Write Software”.

Note: The CPS reads data from the radio. A progress bar is displayed on the computer screen showing the reading status.
After a successful reading, the “Write Software To Phone” window appears on the computer screen.

2. Press the “Write” button.

Note: The application is now being written into the radio. A progress bar is displayed on the computer screen showing the writing status.
After a successful writing, the message “The Operation Was Successful” appears on the computer screen.

3. Press the “OK” button.
4. Click the Toolbar “*R*” (Reset) icon to put radio into normal operating mode.

Manual Mode Testing

Preparation for Testing

1. Verify that the radio is turned off.
2. Press the “1”, “2” and “3” keys together and turn the On/Off knob clockwise to turn the radio on.
3. The display shows “LCD Test Press Any Key To Proceed”.

Tests

Note: Any key that will be pressed will cause the test to advance from one step to the next.

LCD Display Test

1. Press any key consecutively. The display shows horizontal lines that becomes thicker with every key press, until it becomes fully dark.
2. Press any key again, the following appears at the top of the display:

3. Press any key consecutively. The display shows vertical lines that becomes thicker with every key press, until it becomes fully dark.
4. Press any key again. The display shows the Motorola logo.
5. Press any key again. The display shows “Vibrator On”.
   You will need to have an external Smart RSM (RMN5011_ or RMN5012_) to verify that the radio is vibrating.
6. Press any key again. The display shows “Red Led On” and the Red LED at the top of the radio is constantly lit.
7. Press any key again. The display shows “Green Led On” and the Green LED at the top of the radio is constantly lit.
8. Press any key again. The display shows “Both Leds On” and the amber LED at the top of the radio is flashing.
9. Press any key again. The display shows “Backlight On” and the display and keypad backlight are both on.
10. Press any key again. The display shows “Speaker Tone Test”, a tone is heard via the speaker.

11. Press any key again. The display shows “Earpiece Tone Test”, a tone is heard via the earpiece.
12. Press any key again. The display shows “Audio Loopback Test”, speak into the microphone, you should hear your voice via the earpiece.
13. Press any key again. The display shows “Chopper-Noise Test 1”, a low hum must not be heard via the earpiece.
14. Press any key again. The display shows “Chopper-Noise Test 2”, a low hum must not be heard via the earpiece.
15. Press any key again. The display shows the “Rotary Knob Test” map.
16. Rotate the talkgroup knob from location “1” until “16” and make sure at each location the corresponding number disappears from the display.
17. The display proceeds to show all the radio keys, knobs and buttons.
18. Press every radio item one by one. Each item you press causes its respective display to disappear.
19. The display then shows “Press any key to Continue”.
20. Pressing any key will cause display to show a series of “*”, “<“ and “>” characters.
21. Press the Top Navigation key until all top four “*” characters disappear.
22. Press the Bottom Navigation key until all bottom four “*” characters disappear.
23. Press the Left Navigation key until all left four “<” characters disappear.
24. Press the Right Navigation key until all right four “>” characters disappear.
25. After pressing all keys, the display is clear.
26. Turn the radio Off.

CHAPTER 6
MAINTENANCE

Introduction

This chapter provides details about the following:

- Preventive Maintenance (inspection and cleaning)
- Safe Handling of CMOS and LDMOS Devices
- Repair Procedures and Techniques
- Disassembly and Reassembly of the Radio

Preventive Maintenance

The portable radio does not require a scheduled preventive maintenance program. However, periodic visual inspection is recommended.

Inspection

Check that the external surfaces of the radio are clean, and that all external controls and switches are functional. It is not recommended to inspect the interior electronic circuitry.

Cleaning Procedures

The following procedures describe the recommended cleaning agents and methods to be used when cleaning the external and internal surfaces of the radio. External surfaces should be cleaned whenever a periodic visual inspection reveals the presence of smudges, compound, or grime. Internal surfaces (circuit boards and components) should only be cleaned when the radio is disassembled for servicing or repair.

NOTE **Internal surfaces should be cleaned only when the radio is disassembled for service or repair.**

The only recommended agent for cleaning external radio surfaces is a 0.5% solution (one teaspoon of detergent per gallon of water) of mild dishwashing detergent in water. The internal surfaces should only be cleaned with isopropyl alcohol (70% by volume).

CAUTION: The effects of certain chemicals and their vapors can have harmful results on certain plastics. Avoid using aerosol sprays, tuner cleaners and other chemicals.

Cleaning External Plastic Surfaces

Apply the 0.5% detergent-water solution sparingly with a stiff, non-metallic, short-bristled brush to work all loose dirt away from the radio. Use a soft, absorbent, lintless cloth or tissue to remove the solution and dry the radio. Make sure that no water remains entrapped near the connectors, cracks, or crevices.

Cleaning Internal Circuit Boards and Components

Isopropyl alcohol (70%) may be applied with a stiff, non-metallic, short-bristled brush to dislodge embedded or caked materials located in hard-to-reach areas. The brush stroke should direct the dislodged material out and away from the inside of the radio. Make sure that controls or tunable components are not soaked with alcohol. Do not use high-pressure air to hasten the drying process since this could cause the liquid to collect in unwanted places. After completing of the cleaning process, use a soft, absorbent, lintless cloth to dry the area. Do not brush or apply any isopropyl alcohol to the frame, front cover, or back cover.

NOTE **Always use a fresh supply of alcohol and a clean container to prevent contamination by dissolved material (from previous usage).**

Safe Handling of CMOS and LDMOS Devices

Complementary metal-oxide semiconductor (CMOS) devices are used in this family of radios, and are susceptible to damage by electrostatic or high voltage charges. Damage can be latent, resulting in failures occurring weeks or months later. Therefore, special precautions must be taken to prevent device damage during disassembly, troubleshooting, and repair.

Handling precautions are mandatory for CMOS circuits and are especially important in low humidity conditions. DO NOT attempt to disassemble the radio without first referring to the following CAUTION statement.

CAUTION: This radio contains static-sensitive devices. Do not open the radio unless you are properly grounded. Take the following precautions when working on this unit:

- Store and transport all CMOS devices in conductive material so that all exposed leads are shorted together. Do not insert CMOS devices into conventional plastic “snow” trays used for storage and transportation of other semiconductor devices.
- Ground the working surface of the service bench to protect the CMOS device. We recommend using the Motorola Static Protection Assembly (part number 0180386A82), which includes a wrist strap, two ground cords, a table mat, and a floor mat.
- Wear a conductive wrist strap in series with a 100k resistor to ground. (Replacement wrist straps that connect to the bench top covering are Motorola part number RSX-4015.)
- Do not wear nylon clothing while handling CMOS devices.
- Do not insert or remove CMOS devices with power applied. Check all power supplies used for testing CMOS devices to be certain that there are no voltage transients present.
- When straightening CMOS pins, provide ground straps for the apparatus used.
- When soldering, use a grounded soldering iron.
- If at all possible, handle CMOS devices by the package and not by the leads. Prior to touching the unit, touch an electrical ground to remove any static charge that you may have accumulated. The package and substrate may be electrically common. If so, the reaction of a discharge to the case would cause the same damage as touching the leads.

Repair Procedures and Techniques — General

Parts Replacement and Substitution

When damaged parts are replaced, identical parts should be used. If the identical replacement part is not locally available, check the parts list for the proper Motorola part number and order the part from the nearest Motorola Radio Support Center. For details, please refer to relevant Support Depots on page 1-4 to 1-6.

Disassembling and Reassembling the Radio - General

Since these radios may be disassembled and reassembled with the use of only five (board to casting) screws, it is important to pay particular attention to the snaps and tabs and how parts align with each other.

The following tools are required for disassembling the radio:

- chassis opener (6686263Z02)
- flat-head, penknife-size screwdriver
- TORX™ T6 screwdriver (0180320B16)

If a unit requires more complete testing or service than is customarily performed at the basic level, send this unit to a Motorola Authorized Service Center.

Chassis Assembly Disassembly should be performed only if necessary.

Radio Disassembly - Detailed

Front Cover from Chassis Disassembly

1. Turn off the radio.
2. Remove the battery:
   a. Pull down on the two battery-release buttons.
   b. With the buttons pulled down, the top of the battery will fall from the radio.
   c. Remove the battery from the radio.

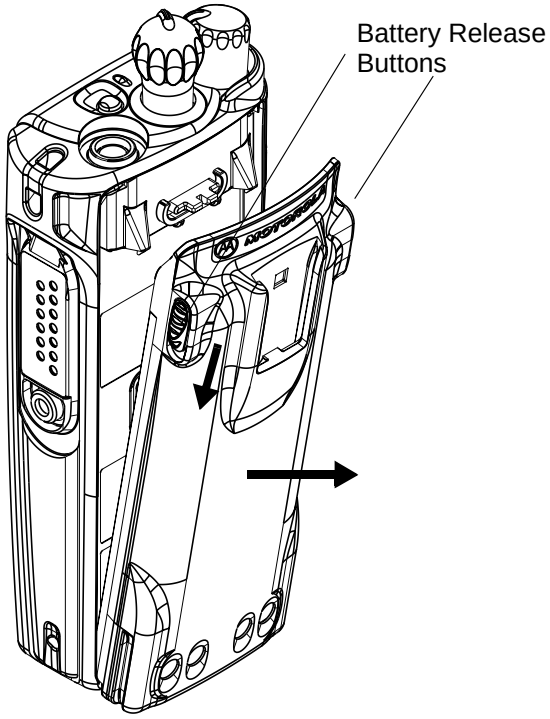


Figure 6-1 Battery Removal

3. Remove the antenna

4. Remove the Talkgroup knob off its shaft.

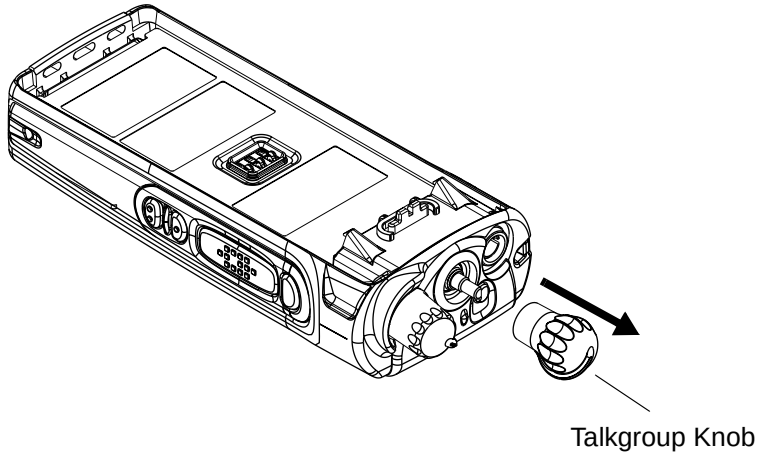


Figure 6-2 Talkgroup Knob Removal

NOTE The knob slides on and off. However, it is supposed to fit very tightly on its shaft.

5. Separate the chassis from the internal electronics front cover assembly as follows:

   a. Insert the chassis opener, or similar instrument, in between the thin retaining wall and the chassis at the bottom of the radio. Do not mar the O-ring sealing underneath the radio housing.

   b. Slowly pry the bottom of the chassis from the cover by pushing the chassis opener down, and prying the handle of the tool over and behind the base of the radio. This prying action forces the thin inner plastic wall toward the base of the radio, releasing the two chassis base tabs.

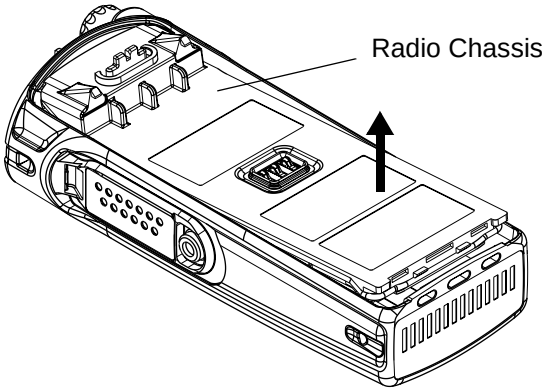


Figure 6-3 Chassis Removal

CAUTION: Marring the front cover O-ring sealing area will prevent the radio from sealing properly.

NOTE Flexible ribbon circuits (flexes) connecting the front cover assembly and the chassis prevent you from completely separating the two units. Display radios and radios with option boards have three flexes.

6. Push the Talkgroup switch shaft back into radio housing to slide chassis away.
7. Gently remove flex from the socket connector.
8. Lay the chassis down. Rotate the front cover backward and slightly away from the chassis.
9. Lift the latches on the main circuit board to release the flexes from their connectors.

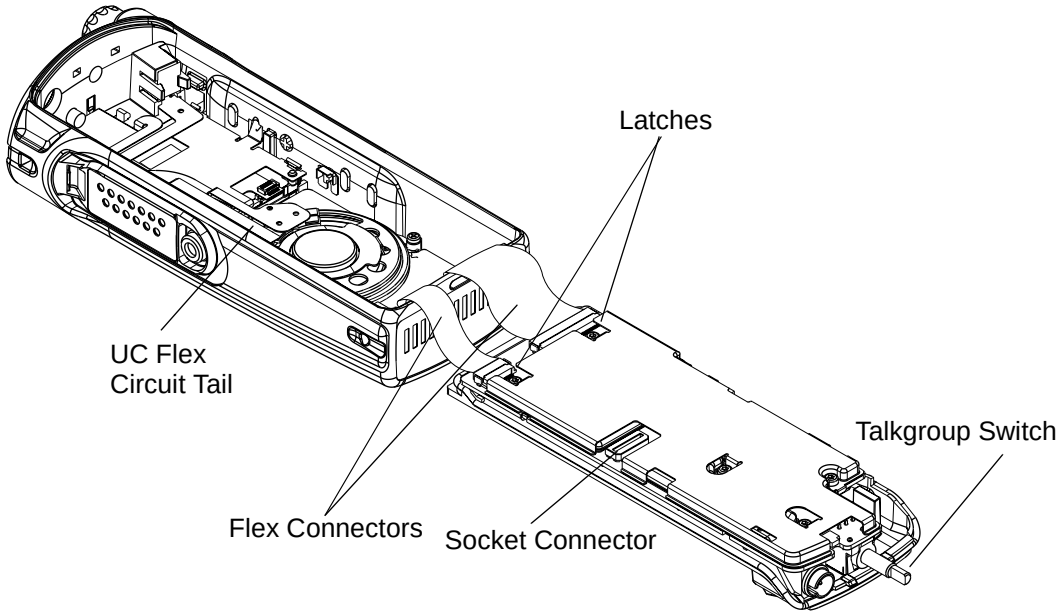


Figure 6-4 Unlatch Flex Connectors

Chassis Assembly Disassembly

1. Use a TORX™ screwdriver with a T6 head to remove the five screws holding the secondary shield and main board to the chassis.

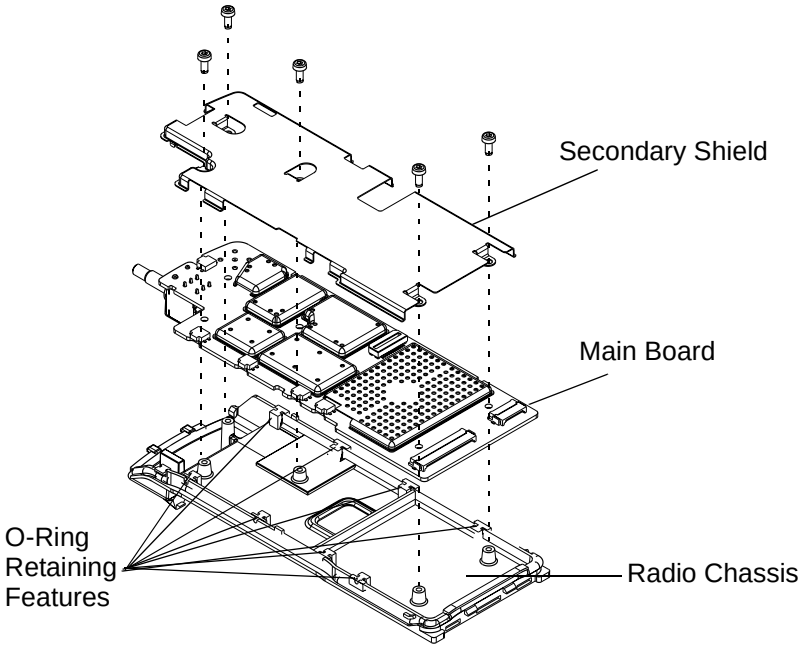


Figure 6-5 Remove Main Board from Chassis

2. Lift the secondary shield and main board from the chassis (See Figure 6-5).

CAUTION: Refer to the CMOS CAUTION paragraph on page 3 before removing the main board. Be sure to use ESD protection when handling circuit boards.

3. Remove the eight small O-ring retainers from their slots in the chassis. Note the alignment of the retainers for reassembly.

4. Remove the O-ring.

Radio Reassembly - Detailed

Chassis Assembly Reassembly

1. Reassemble the O-ring. The tabs on the O-ring should reach around the chassis and point down.
2. Place the eight small O-ring retainers into their slots in the chassis.

NOTE When properly assembled, the retainers on the O-ring should align with the slots on the chassis. If this is not the case, remove and replace the O-ring until it is aligned with the chassis and completely seated in place around the perimeter.

3. Make sure the battery contact module is properly sealed on the RF board.
4. Place the main board and secondary shield straight down on top of the chassis.
5. Use the TORX™ screwdriver with a T6 head to fasten the 5 screws holding the secondary shield and main board to the chassis. Torque the screws to 0.3Nm (3lbf.in).

Chassis and Front Cover Reassembly

1. Align the chassis assembly end-to-end with the front cover assembly.
2. Insert the tails of the flex circuits into their respective connectors at the bottom of the front cover.
3. Push down the latches on the connectors to hold the flex circuits to the main board.
4. Attach the UC flex circuit tail to the socket connector.
5. Slide the Talkgroup switch shaft into position in the front cover.
6. Push the chassis assembly completely into the top of the front cover until it settles in place.
7. Be sure the O-ring is properly seated.
8. Snap the bottom of the chassis into the front cover.
9. Reassemble the Talkgroup knob, antenna and battery.

10. Turn on the Volume knob and make sure radio powers up normally.

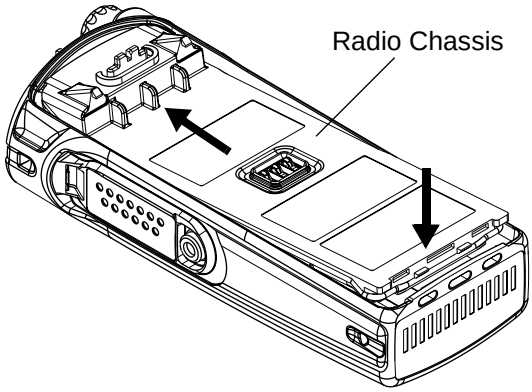


Figure 6-6 Fastening the Chassis

Service Aids

The following table lists the service aids recommended for working on the radio. While all of these items are available from Motorola, most are standard workshop equipment items and any equivalent item capable of the same performance may be substituted for the item listed.

Motorola Part No.	Description	Application
PMLN4510_	Programming Stand	Pocket for connecting to radio/Programming/Flashing with CPS.
FLN9636_	Programming Cable	Cable to connect PC to programming stand.
PMLN4504_	Data Cable	Cable for data transfer.
RLN4510_	Battery Eliminator Regulator, 7.5V	Regulator to power radio via battery eliminator cable.
0180305J49	Battery Eliminator Cable	Interconnects radio to power supply.
5880384G68	Antenna Adapter	SMA-BNC
6686263Z02	Chassis Opener	Tool to separate chassis from front cover housing.
0180320B16 6680321B81 6680321B56	Torx Screw Driver Kit (T6,8,10,15,25) Torx Bit Insert Bit extra long	Tool to remove torx screws in radio.
-	Phillips Screw Driver	Tool to remove speaker retainer.
-	Flat-head, Penknife-size Screw Driver	Tool to remove display retainer.

MTP700 Unit - Exploded View

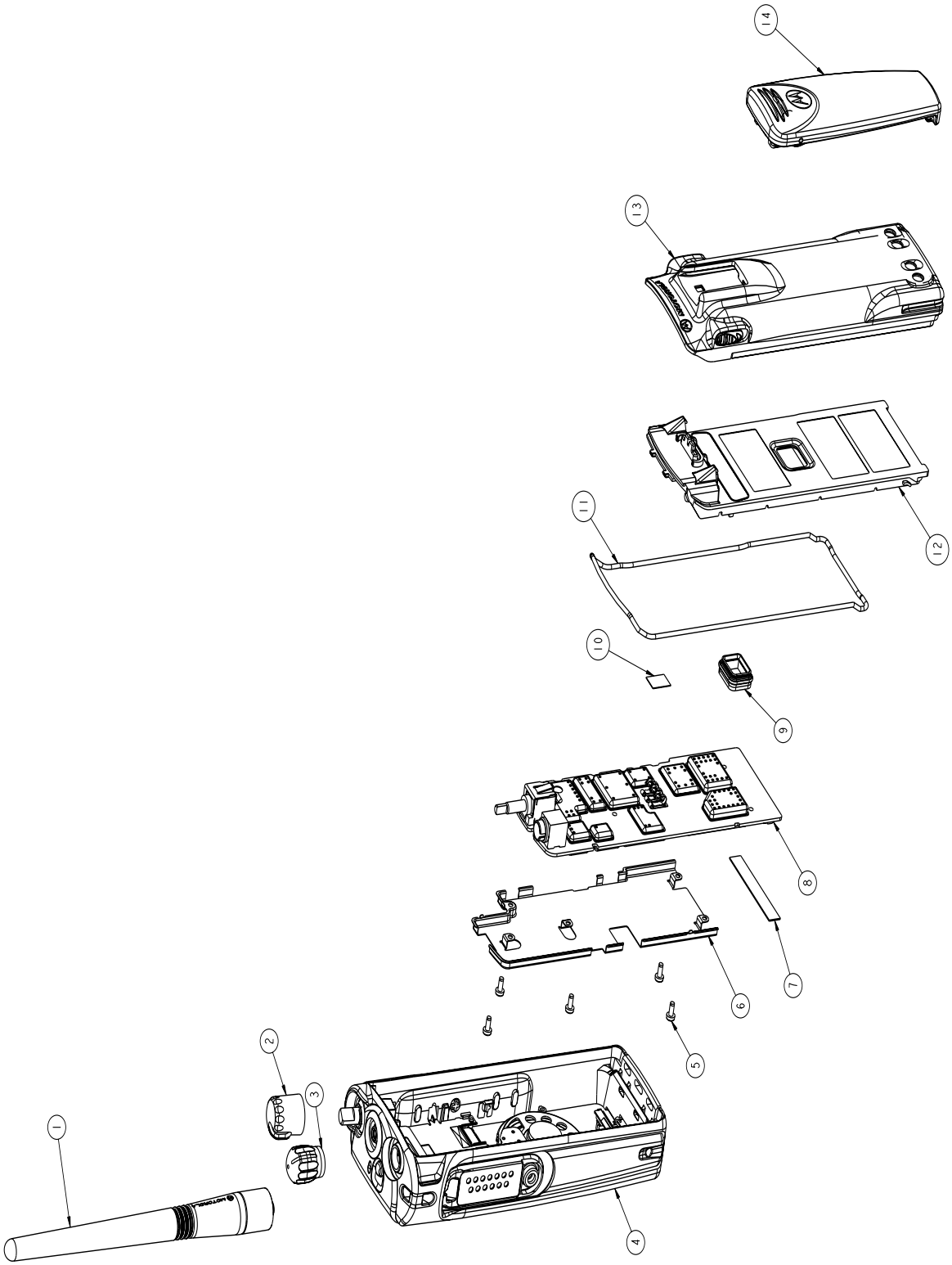


Figure 6-7 MTP700 - Exploded view

MTP700 components are listed in the table below. The first column marked with a # sign provides you with the call out numbers of the components as marked in MTP700 - Exploded view.

Parts contained in this manual are the only ones that will be available for replacement.

MTP700 Components List

#	Description	Part #
1a	Antenna, 380 - 400 MHz	8505644V11
1b	Antenna, 410 - 430 MHz	8505644V04
1c	Antenna, 806-870 MHz, stubby	8505241U06
1d	Antenna, 806-870 MHz, whip	8505241U03
2	Knob, Volume	3686050Z01
3	Frequency Knob	3686485Z01
4a	Front Cover Kit (ES)	PMHN4039A
4b	Front Cover Kit (CR)	PMHN4038A
4c	Front Cover Kit (Kor Mod)	PMHN4040A
5	Screw, Torx™ T6, Machine	0386104Z01
6	**Secondary Shield	2686046Z01
7	Escutcheon, ZIF	1386262Z01
8	*Main Board	Refer to Appendix A
9	Seal, Battery Contact Module	3280534Z01
10	Thermal Pad	7580556Z01
11	Gasket, O-Ring	3286006Z01
12	Chassis	2786007Z01
13a	Battery, LiIon, Std, 1200 mAh	PMNN4047A
13b	Battery, LiIon, Lite, 850 mAh	PMNN4050A
13c	Battery, NiMH, 1200 mAh	PMNN4048A
13d	Battery, NiMH, FM, 1150 mAh	PMNN4049A
14	Beltclip	HLN9844

Note: * Reference Only
Replacement or repair of all internal boards is not authorized in Latin America.

** The secondary shield is not placed for PMUF1115A Super Tanapa.

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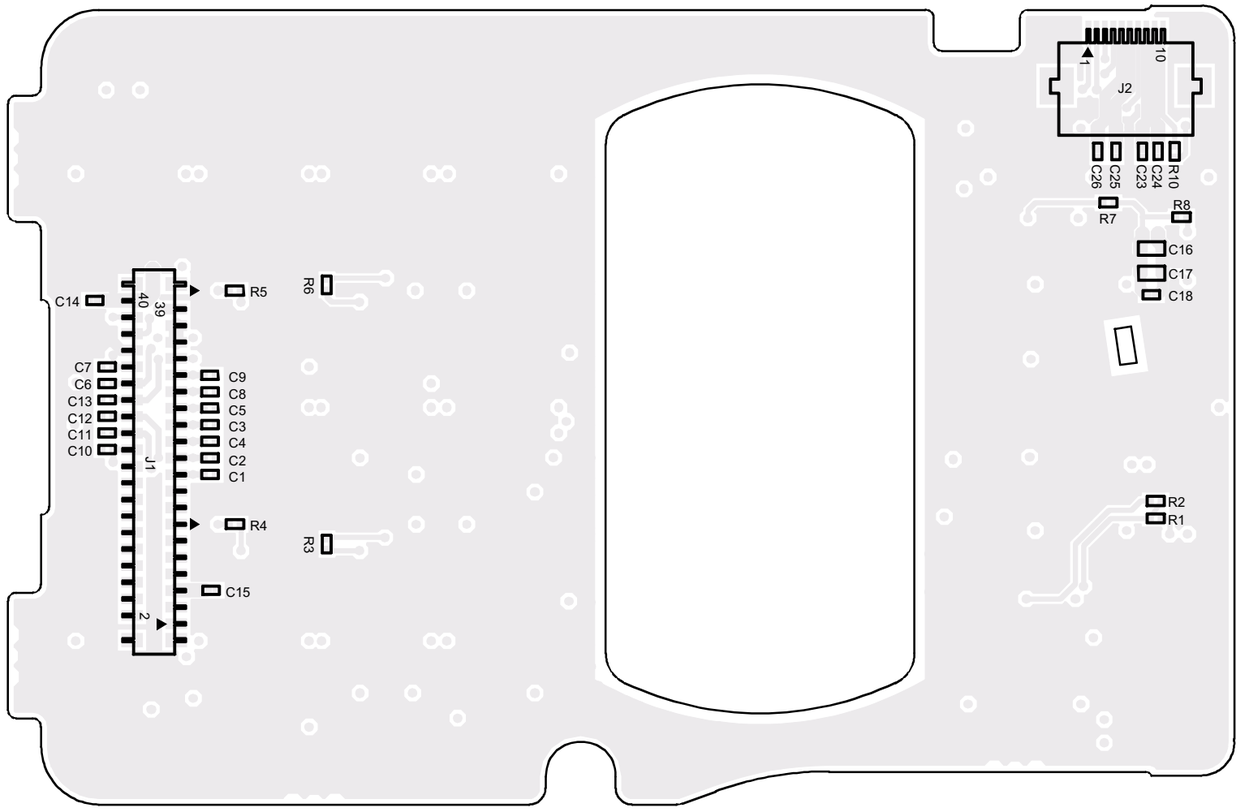
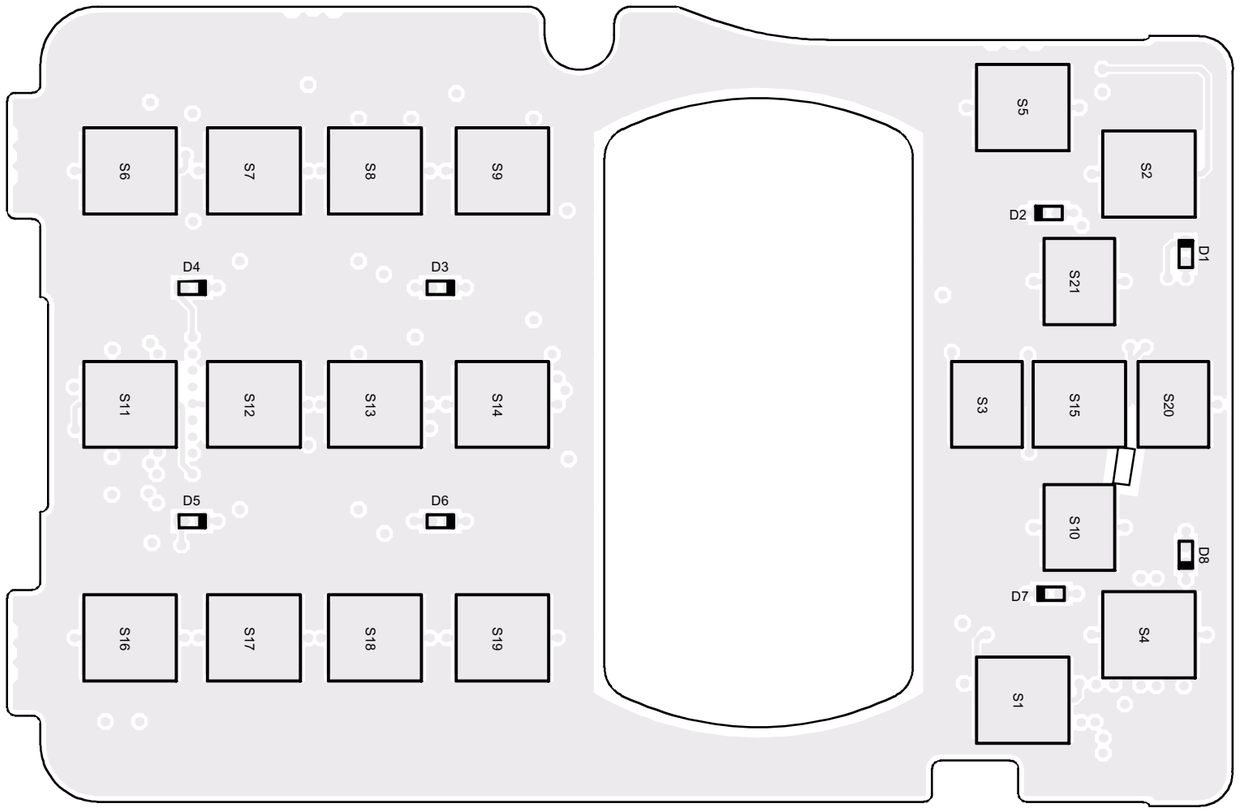
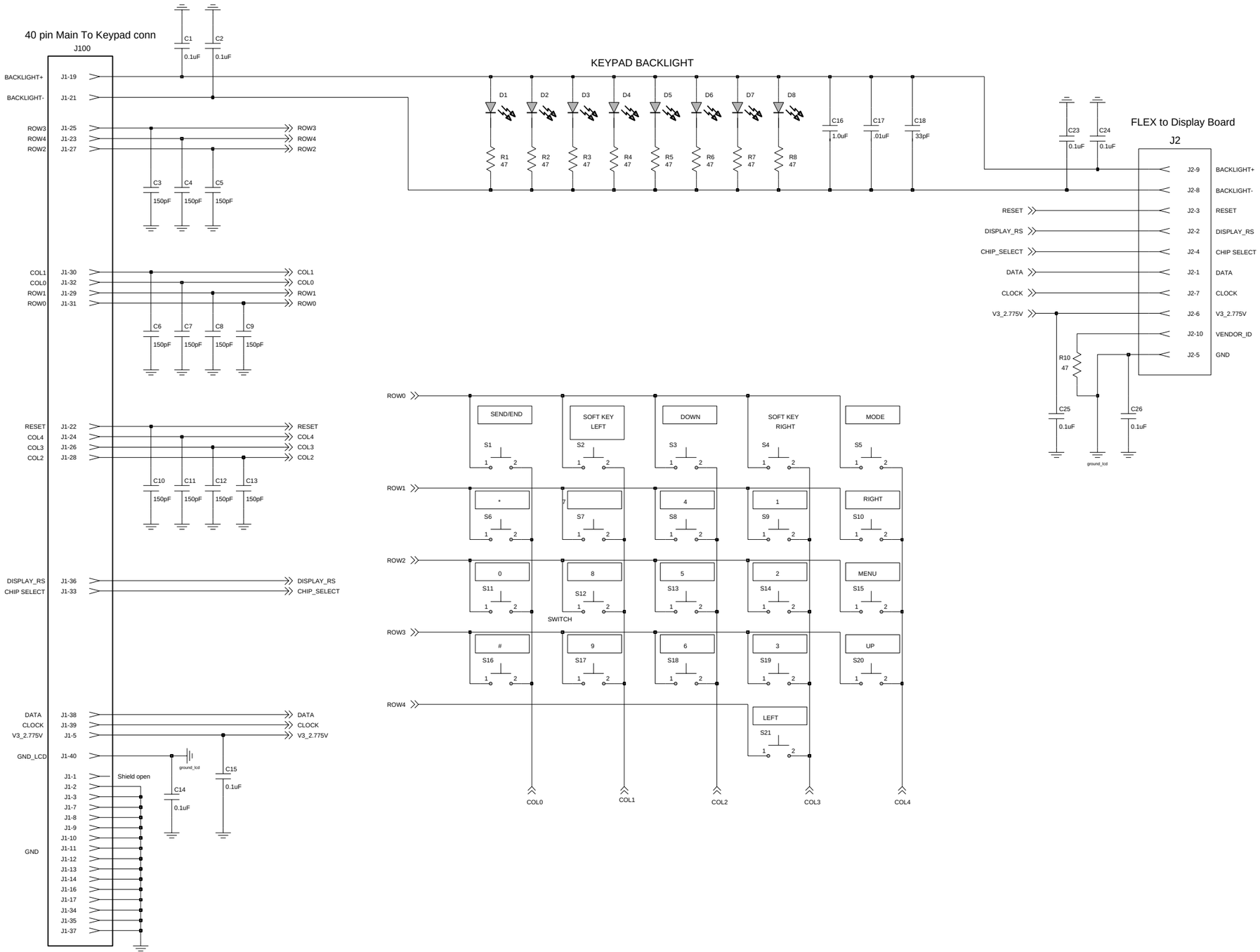
CHAPTER 7
KEYPAD BOARD LAYOUT, SCHEMATICS & PARTS LIST



Keypad Board Top Side PCB No. 8466556A01



Keypad Board Bottom Side PCB No. 8466556A01



Keypad Board Schematic Diagram

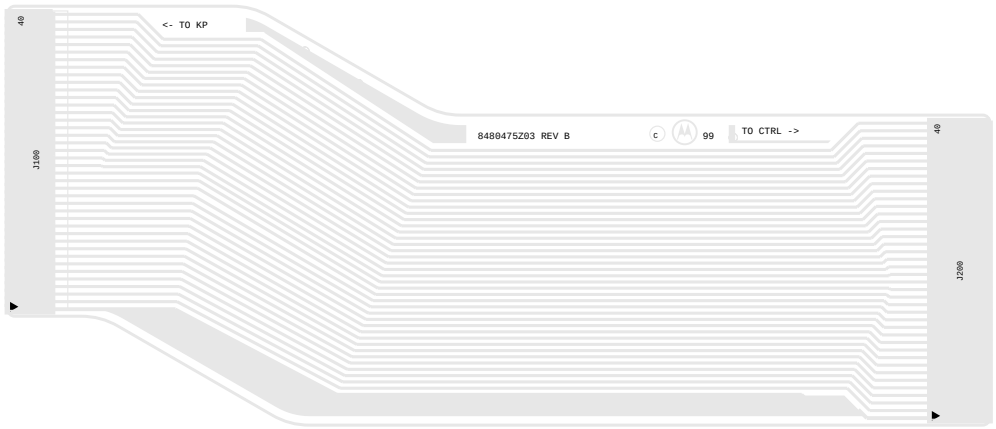
Keypad Board Parts List

Circuit Ref	Motorola Part No.	Description
C1	2113928N01	CAP CER CHIP 0.1uF 10% 6.3V X5R 0402
C2	2113928N01	CAP CER CHIP 0.1uF 10% 6.3V X5R 0402
C3	2113743N54	CAP CER CHIP 0.1uF 10% 6.3V X5R 0402
C4	2113743N54	CAP CER CHIP 0.1uF 10% 6.3V X5R 0402
C5	2113743N54	CAP CER CHIP 0.1uF 10% 6.3V X5R 0402
C6	2113743N54	CAP CER CHIP 0.1uF 10% 6.3V X5R 0402
C7	2113743N54	CAP CER CHIP 0.1uF 10% 6.3V X5R 0402
C8	2113743N54	CAP CER CHIP 0.1uF 10% 6.3V X5R 0402
C9	2113743N54	CAP CER CHIP 0.1uF 10% 6.3V X5R 0402
C10	2113743N54	CAP CER CHIP 0.1uF 10% 6.3V X5R 0402
C11	2113743N54	CAP CER CHIP 0.1uF 10% 6.3V X5R 0402
C12	2113743N54	CAP CER CHIP 0.1uF 10% 6.3V X5R 0402
C13	2113743N54	CAP CER CHIP 0.1uF 10% 6.3V X5R 0402
C14	2113928N01	CAP CER CHIP 0.1uF 10% 6.3V X5R 0402
C15	2113928N01	CAP CER CHIP 0.1uF 10% 6.3V X5R 0402
C16	2113928A01	CAP CER CHIP 1.0uF +80/-20% 10V Y5V 0603
C17	2113741F49	CAP CER CHIP 10000pF 5% 50V X7R 0603
C18	2113743N38	CAP CER CHIP 33.0pF 5% 16V COG 0402
C23	2113928N01	CAP CER CHIP 0.1uF 10% 6.3V X5R 0402
C24	2113928N01	CAP CER CHIP 0.1uF 10% 6.3V X5R 0402
C25	2113928N01	CAP CER CHIP 0.1uF 10% 6.3V X5R 0402
C26	2113928N01	CAP CER CHIP 0.1uF 10% 6.3V X5R 0402
D1	4809496B11	LED CHIP YEL-GRN 1608 CL191YG
D2	4809496B11	LED CHIP YEL-GRN 1608 CL191YG
D3	4809496B11	LED CHIP YEL-GRN 1608 CL191YG
D4	4809496B11	LED CHIP YEL-GRN 1608 CL191YG
D5	4809496B11	LED CHIP YEL-GRN 1608 CL191YG
D6	4809496B11	LED CHIP YEL-GRN 1608 CL191YG
D7	4809496B11	LED CHIP YEL-GRN 1608 CL191YG
D8	4809496B11	LED CHIP YEL-GRN 1608 CL191YG
J1	0980521Z01	CONN, ZIF VERTICAL,40 PIN
J2	0986016Z01	CONNECTOR, 10 PIN FPC
P1	NOTPLACED	GCAM DUMMY PART NUM-BER
P2	NOTPLACED	GCAM DUMMY PART NUM-BER
R1	0662057M42	RES CHIP 47 5% 0.063W 0402
R2	0662057M42	RES CHIP 47 5% 0.063W 0402
R3	0662057M42	RES CHIP 47 5% 0.063W 0402
R4	0662057M42	RES CHIP 47 5% 0.063W 0402
R5	0662057M42	RES CHIP 47 5% 0.063W 0402
R6	0662057M42	RES CHIP 47 5% 0.063W 0402
R7	0662057M42	RES CHIP 47 5% 0.063W 0402
R8	0662057M42	RES CHIP 47 5% 0.063W 0402
R10	NOTPLACED	GCAM DUMMY PART NUM-BER
	8466556A01	KEYPAD BOARD

CHAPTER 8

FLEX LAYOUT, SCHEMATICS & PARTS LISTS

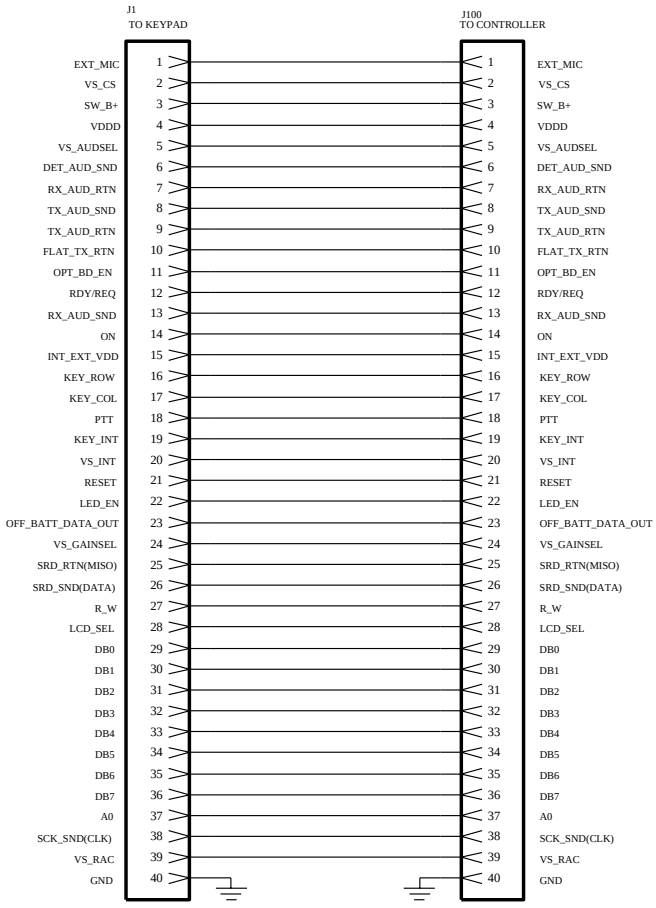
Interconnect Flex



Front Metal
View From Top Side

Back Metal
View From Top Side

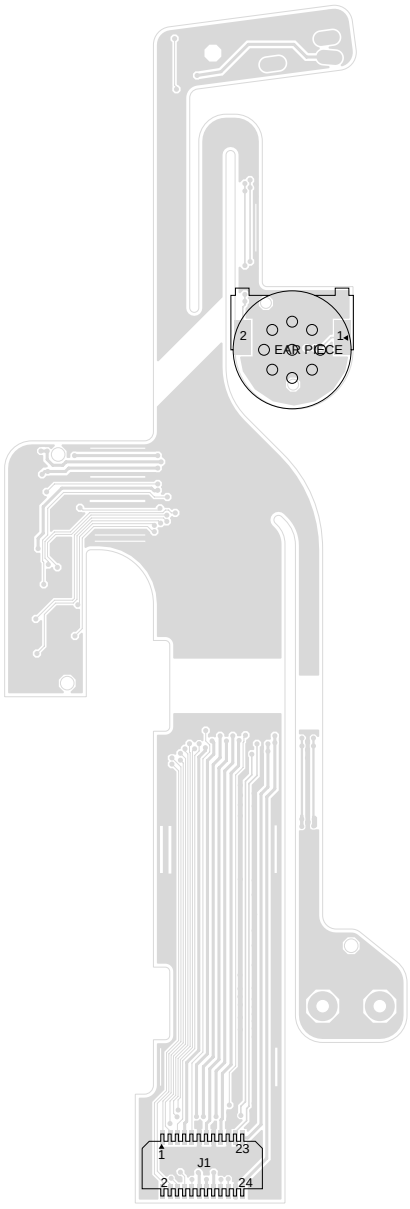
Schematic for Interconnect Flex



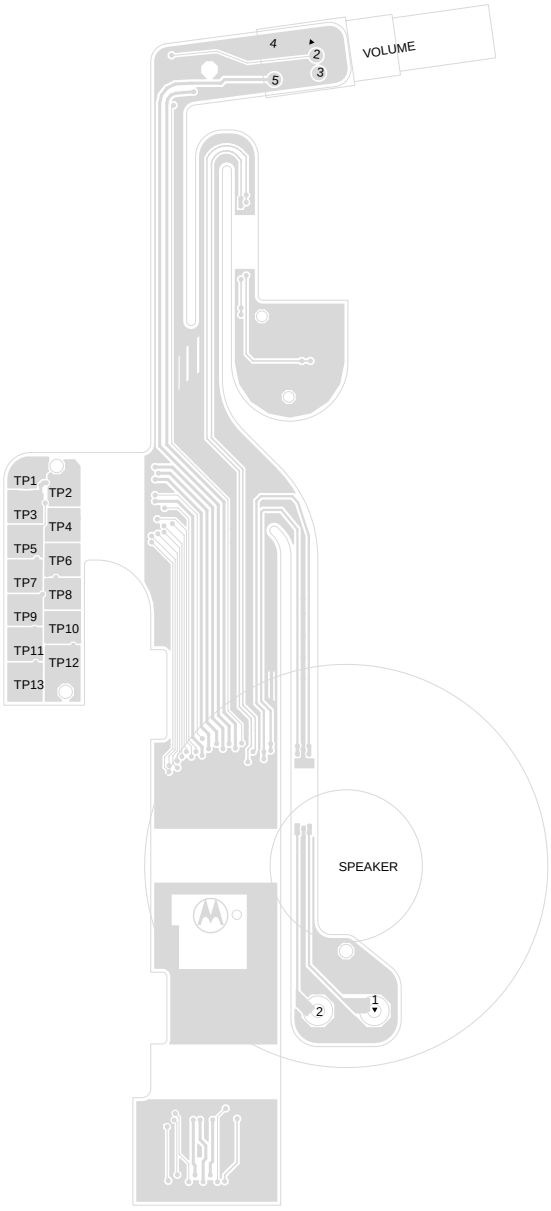
Parts List for Interconnect Flex

Reference Symbol	Motorola Part No.	Description
J100	0980521Z01	Connector, ZIF, Vertical 40 pin
J200	0905505Y04	Connector, ZIF, Horizontal, 40 pin

Universal Connector Flex

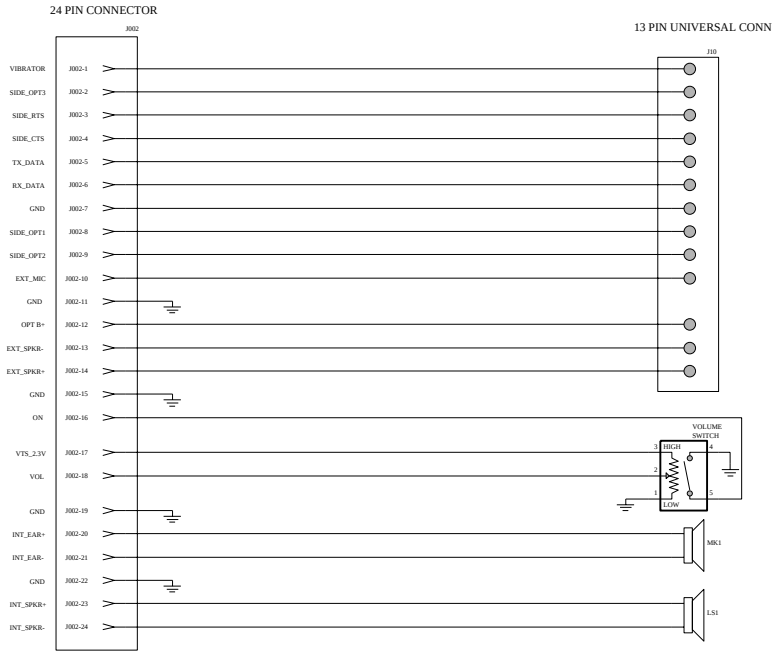


Front Metal
View From Top Side



Back Metal
View From Top Side

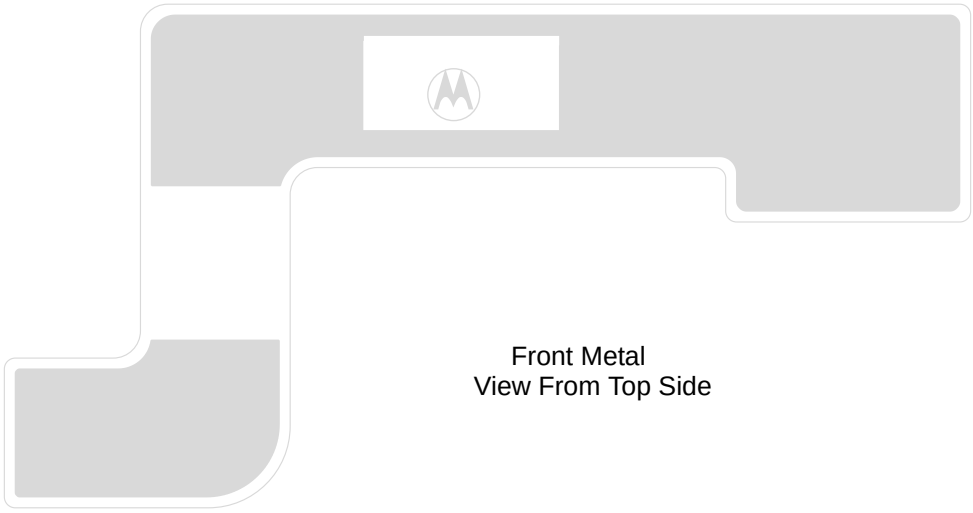
Schematic for Universal Connector Flex



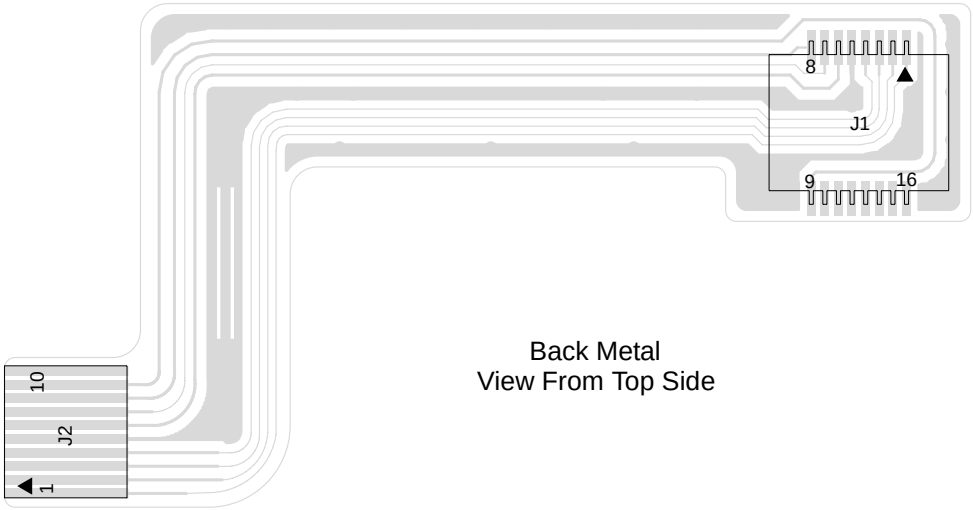
Parts List for Universal Connector Flex

Reference Symbol	Motorola Part No.	Description
Ear Piece	5004154G01	Earpiece
J002	0986226Z01	Connector, 24 pin, header
Speaker	5085738Z05	Speaker
Volume	1886009Z01	Volume Potentiometer

Display Flex

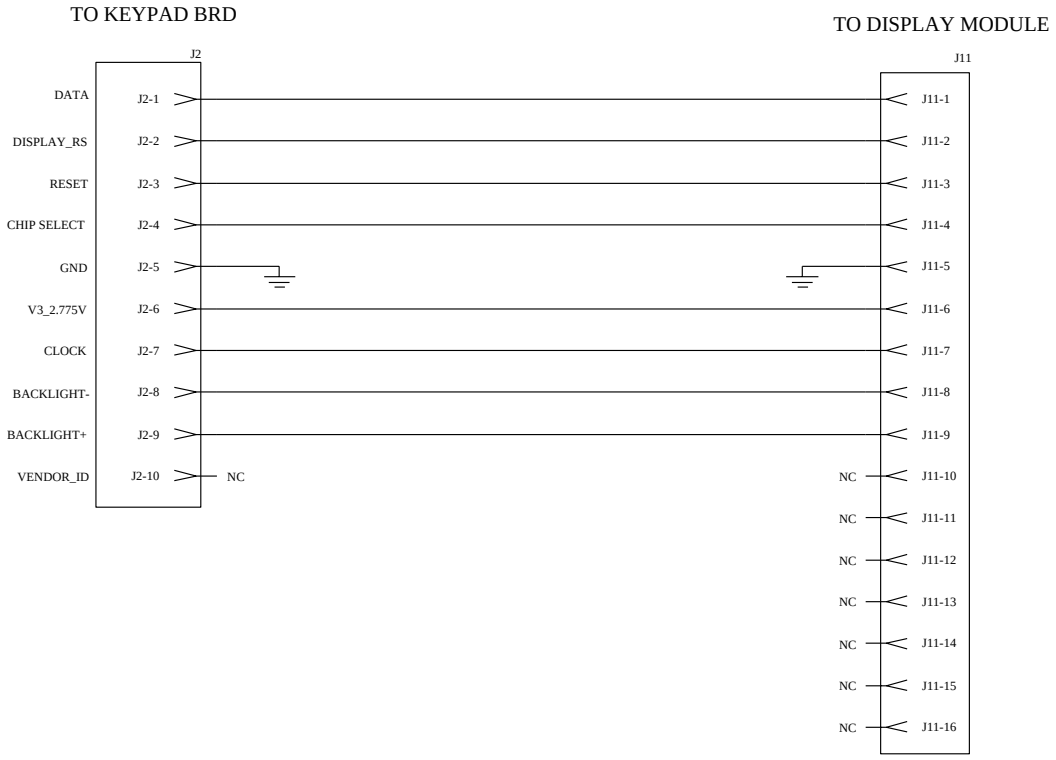


Front Metal
View From Top Side



Back Metal
View From Top Side

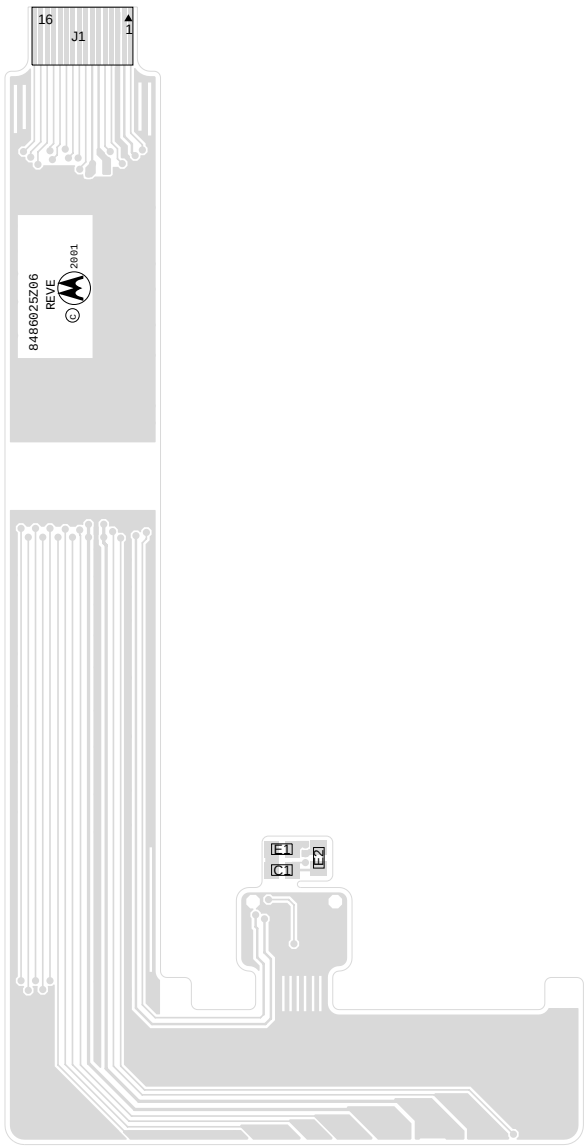
Schematic for Display Flex



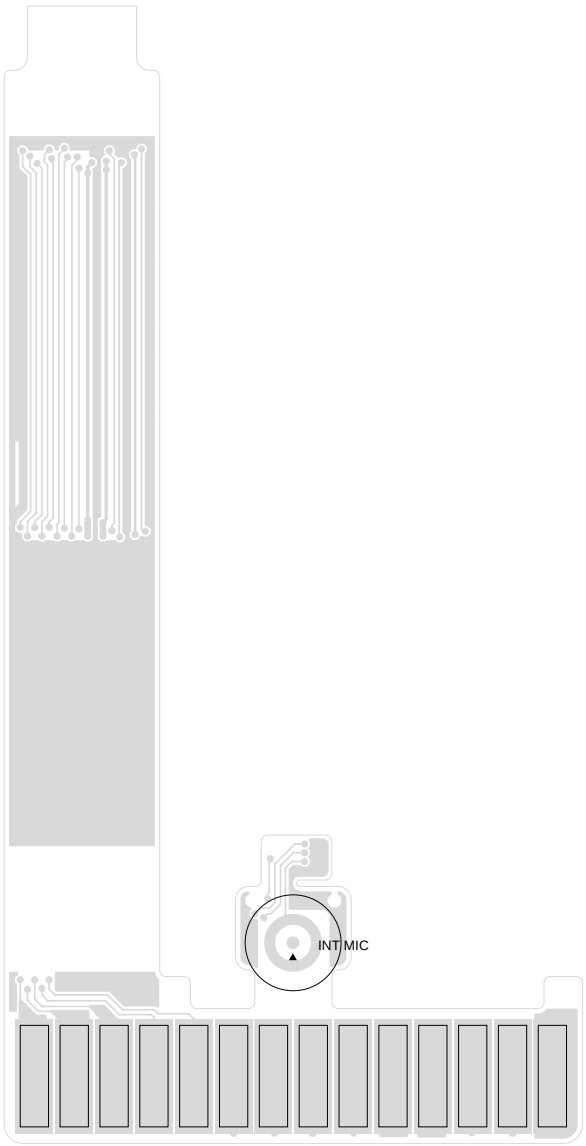
Parts List for Display Flex

Reference Symbol	Motorola Part No.	Description
J2	0986016Z01	Connector, ZIF, 10 pin
J11	0987817K02	Connector, 16 pin

Bottom Flex

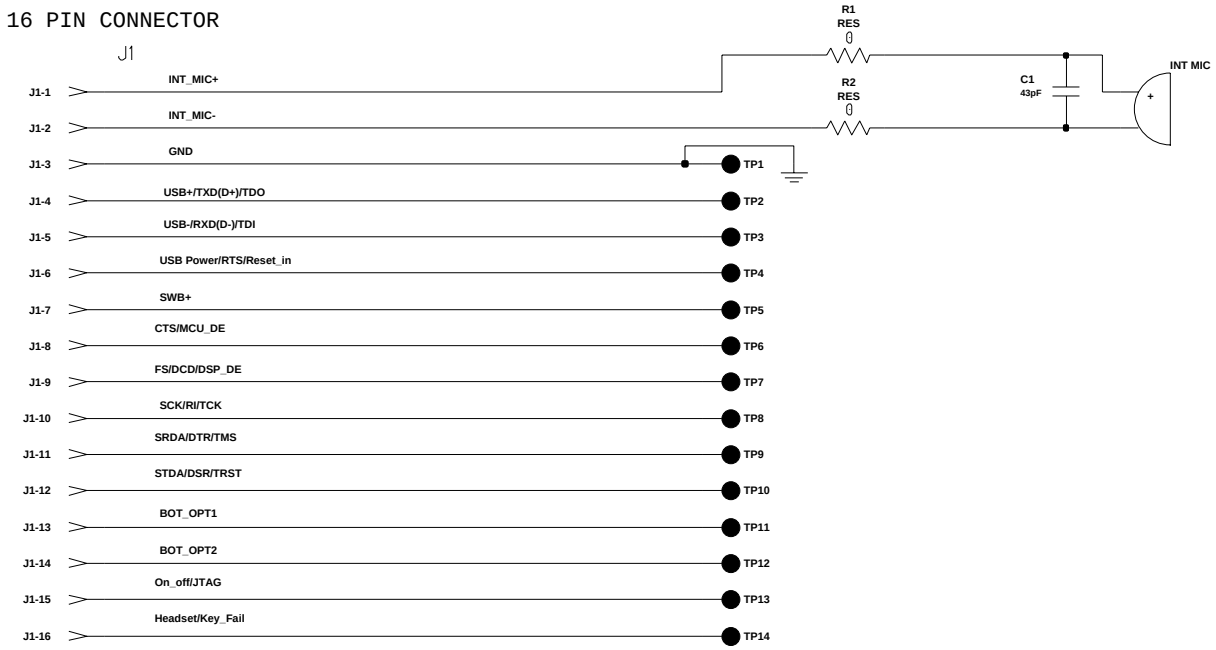


Front Metal
View From Top Side



Back Metal
View From Top Side

Schematic for Bottom Flex



Parts List for Bottom Flex

Reference Symbol	Motorola Part No.	Description
C1	2113740F42	Capacitor, 43pF
R1	0662057B47	0 ohm Resistor
R2	0662057B47	0 ohm Resistor
INT MIC	5085600J01	Speaker
J1	0980472U02	Connector, ZIF, 16 Pin

APPENDIX A
REPLACEMENT PARTS AND KITS

Servicing MTP700 Portable Units

Service for the portable units is based on the substitution method; a faulty part is replaced by a working one, providing quicker service to the customer. For example, if the transceiver board is faulty, it is replaced. If the portable requires more complete testing or servicing than that is available at field level, it is sent to your nearest Radio Service Center; where it is serviced.

The MTP700 portables are programmed at the factory. They cannot be tuned at the field service level.

Level 1 and Level 2 Maintenance

This manual covers Level 1 and Level 2 Maintenance: at Level 1 Maintenance you replace the transceiver and/or accessories and send the faulty transceiver and/or accessories to a higher level of maintenance; at Level 2 Maintenance a faulty kit is replaced.

For Latin America Level 1 and Level 2 Maintenance contact your local Motorola CGISS office for information. For details, please refer to relevant Support Depots on page 1-4 to 1-6.

Level 3 Maintenance

All Radio Support Depots outside of Latin America are level 3 service partners. The depots are capable of performing repairs down to component level where retuning is required. Contact your local CGISS office for information. For details, please refer to relevant Support Depots on page 1-4 to 1-6.

Replacement Parts

Damaged parts should be replaced with identical replacement parts. For complete information on ordering required parts and kits, contact your local customer service representative.

Service Kits

Model	Model Description
P1	MTP700, **380-430 MHz**, 1 W, 25 kHz, with **C**ontinuous **R**otary knob for group selection (CR)
P2	MTP700, **380-430 MHz**, 1 W, 25 kHz, with **E**nd **S**top knob for group selection (ES)
P3	MTP700, **806-870 MHz**, 1 W, 25 kHz, with **C**ontinuous **R**otary knob for group selection (CR)
P4	MTP700, **806-870 MHz**, 1 W, 25 kHz, with **E**nd **S**top knob for group selection (ES)
P5	MTP700, **806-870 MHz**, 1 W, 25 kHz, with **E**nd **S**top knob for group selection (ES), Korean model

Description		**380-430 MHz**		**806-870 MHz**		
*** Service Boards**	**Kit Number**	**P1**	**P2**	**P3**	**P4**	**P5**
***Transceiver FRU 380-430M 1W 25K CR	PMUE1825BS	x				
***Transceiver FRU 380-430M 1W 25K ES	PMUE1826BS		x			
***Transceiver FRU 806-870M 1W 25K CR	PMUF1077BS			x		
***Transceiver FRU 806-870M 1W 25K ES	PMUF1078BS				x	
***Transceiver FRU 380-430M 1W 25K CR-TEA1	PMUE1852BS	x				
***Transceiver FRU 380-430M 1W 25K ES-TEA1	PMUE1853BS		x			
***Transceiver FRU 806-870M 1W 25K CR-TEA1	PMUF1092BS			x		
***Transceiver FRU 806-870M 1W 25K ES-TEA1	PMUF1093BS				x	
***Transceiver FRU 380-430M 1W 25K CR-TEA2	PMUE1856BS	x				
***Transceiver FRU 380-430M 1W 25K ES-TEA2	PMUE1857BS		x			
***Transceiver FRU 806-870M 1W 25K CR-TEA2	PMUF1096BS			x		
***Transceiver FRU 806-870M 1W 25K ES-TEA2	PMUF1097BS				x	
Transceiver 806-870M 1W 25K ES (Eriko)	PMUF1115AS					x
Transceiver FRU 380-430M 1W 25K CR (Chinese)	PMUE2052AS	x				
Transceiver FRU 380-430M 1W 25K ES (Chinese)	PMUE2053AS		x			
Transceiver FRU 806-870M 1W 25K CR (Chinese)	PMUF1157AS			x		
Transceiver FRU 806-870M 1W 25K ES (Chinese)	PMUF1158AS				x	
Transceiver FRU 380-430M 1W 25K CR (Korean)	PMUE2054AS	x				
Transceiver FRU 380-430M 1W 25K ES (Korean)	PMUE2055AS		x			

Description		380-430 MHz		806-870 MHz		
Transceiver FRU 806-870M 1W 25K CR (Korean)	PMUF1159AS			x		
Transceiver FRU 806-870M 1W 25K ES (Korean)	PMUF1160AS				x	
Transceiver FRU 380-430M 1W 25K CR-TEA1 (Chinese)	PMUE2056AS	x				
Transceiver FRU 380-430M 1W 25K ES-TEA1 (Chinese)	PMUE2057AS		x			
Transceiver FRU 806-870M 1W 25K CR-TEA1 (Chinese)	PMUF1161AS			x		
Transceiver FRU 806-870M 1W 25K ES-TEA1 (Chinese)	PMUF1162AS				x	
Transceiver FRU 380-430M 1W 25K CR-TEA1 (Korean)	PMUE2058AS	x				
Transceiver FRU 380-430M 1W 25K ES-TEA1 (Korean)	PMUE2059AS		x			
Transceiver FRU 806-870M 1W 25K CR-TEA1 (Korean)	PMUF1163AS			x		
Transceiver FRU 806-870M 1W 25K ES-TEA1 (Korean)	PMUF1164AS				x	
Front Cover	**Kit Number**	**P1**	**P2**	**P3**	**P4**	**P5**
Front Housing Kit (CR)	PMHN4038A	x		x		
Front Housing Kit (ES)	PMHN4039A		x		x	
Front Housing Kit (ES) (Eriko)	PMHN4040A					x
Front Housing Kit CR (English/Chinese)	PMHN4048A	x		x		
Front Housing Kit CR (English/Korean)	PMHN4049A	x		x		
Front Housing Kit ES (English/Chinese)	PMHN4050A		x		x	
Front Housing Kit ES (English/Korean)	PMHN4051A		x		x	

Note: * These boards include the main board and chassis.
*** Not Field Replaceable for Latin America.

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APPENDIX B
CONNECTOR PIN FUNCTIONS

General

This appendix describes the connector pin functions for the Radio. The description gives information on the type of signals, voltages and current conditions. Pins which are marked with no function, should not be connected

Side Accessory Connector Pin Assignment

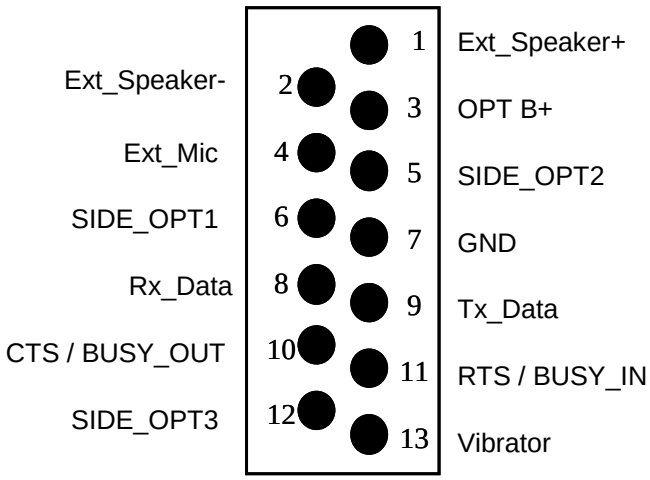

Figure B-1 Side Accessory Connector Pin Assignment

Pin	Name	Function	Description
1	EXT_SPEAKER+	OUT	Speaker + (pin 1) and Speaker - (pin 2) are used for the external speaker. Typical output power is 0.5W for a 20 ohm load.
2	EXT_SPEAKER-	OUT	Speaker + (pin 1) and Speaker - (pin 2) are used for the external speaker. Typical output power is 0.5W for a 20 ohm load.
3	OPT_B+	OUT	With a side accessory attached, this pin provides a typical voltage of 7.5V. It is current limited at 800mA against short circuit protection.
4	EXT_MIC	IN	This is the external microphone input. Input impedance is 2 kohm with a biasing voltage of 2.775V and a typical input level of 8 mVrms.
5	SIDE_OPT2	IN	SIDE_OPT1, 2 and 3 selects the various radio operation modes with different accessories.
6.	SIDE_OPT1	IN	SIDE_OPT1, 2 and 3 selects the various radio operation modes with different accessories.
7.	GND	IN/OUT	Used as ground.
8	RX_DATA	IN	RS-232 input data.
9	TX_DATA	OUT	RS-232 output data.
10	CTS/BUSY_OUT	OUT	Used as Clear-To-Send in RS-232 communication. BUSY_OUT is used as handshake output for SB9600 communication.
11.	RTS/BUSY_IN	IN	Used as Request-To-Send in RS-232 communication. BUSY_IN is used as handshake input for SB9600 communication.
12.	SIDE_OPT3	IN	SIDE_OPT1, 2 and 3 selects the various radio operation modes with different accessories.
13.	VIBRATOR	OUT	This is a logic output to enable the vibrator motor in some accessories.

Table B-1 Side Accessory Connector Pin Functions

Bottom Accessory Connector Pin Assignment

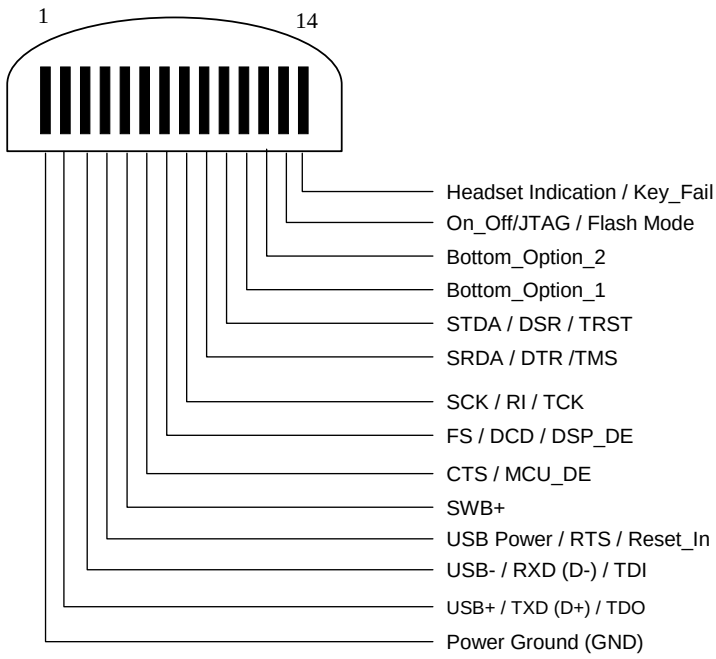

Figure B-2 Bottom Accessory Connector Pin Assignment

Pin	Name	Function	Description
1	POWER GROUND	IN/OUT	Used as ground.
2	USB+/TXD (D+)/TDO	IN/OUT	+ve signal for the USB bus/transmit data in RS-232 mode/serial output in JTAG Mode.
3	USB-/RXD (D-)/TDI	IN/OUT	-ve signal for the USB bus/receive data in RS-232 mode/serial input in JTAG Mode.
4	USB_POWER/RTS/ RESET_IN	IN	5V power from USB Host/Used as Request-T0-Send in RS-232/Reset input in JTAG Mode.
5	SWB+	OUT	With a bottom accessory attached, this pin provides a typical voltage of 7.5V. It is current limited at 800mA against short circuit protection.
6.	CTS/MCU_DE	OUT/IN	Used as Clear-To-Send in RS-232 mode/MCU Debug Event function in JTAG Mode.
7.	FS/DCD/DSP_DE	IN/OUT	This pin is used as Frame Sync in SSI mode/Used as Data Carrier Detect in RS-232 mode/DSP Debug Event function in JTAG Mode.
8	SCK/RI/TCK	IN/OUT	This pin is used as Serial Clock in SSI mode/Used as RingIndicator in RS-232 mode/Test Clock in JTAG Mode.
9	SRDA/DTR/TMS	IN	This pin receives serial data in SSI mode/Used as Data Terminal Ready in RS-232 Mode/Test.
10	STDA/DSR/TRST	OUT	This pin transmit serial data in SSI mode/Used as Data Set Ready in RS-232 Mode/Test Reset in JTAG Mode.
11.	BOTTOM_OPTION_1	IN	BOTTOM_OPTION1 and 2 selects the varioius radio operation modes with different accessories.
12.	BOTTOM_OPTION_2	IN	BOTTOM_OPTION1 and 2 selects the various radio operation modes with different accessories.
13.	ON_OFF/JTAG/FLASH MODE	IN	Turns on the radio in SB9600 Mode/Puts the radio into JTAG Mode/Puts the radio into FLASH Mode.
14.	HEADSET INDICATION/KEY_FAIL	IN	Indicates a headset accessory is being used/Used to load the secure key for encryption.

Table B-2 Bottom Accessory Connector Pin Functions

APPENDIX C
TEST EQUIPMENT

WARNING

Any level 3 repairs can deeply affect the performance of the MTP700 radio and may cause a new tuning procedure.
This tuning procedure can only be applied by cerain authorised Motorola depots where the appropriate TEST & TUNE EQUIPMENT is available.
The appropriate TEST & TUNE EQUIPMENT is a special automated test equipment which is only available at some Motorola factories and Motorola repair centers.

Test Equipment

The table below lists the special test equipment required for servicing TETRA Portable Radios.

Motorola Part No.	Description
WADN4161A*	TETRA SERVICE MONITOR, MOBILES ONLY
WADN4163A	TETRA SERVICE MONITOR, MOBILES AND DIRECT MODE
WADN4164A	TETRA SERVICE MONITOR, MOBILES AND BASE STATIONS
WADN4173A	TETRA SERVICE MONITOR, MOBILES, DIRECT MODE AND BASE STATIONS
WADN4233A	TETRA SERVICE MONITOR, MOBILES, DIRECT MODE AND MPT1327/1343

NOTE:* WADN4161A is the minimum required for testing TETRA Radios

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APPENDIX D
SELF CHECK (ERROR & FAIL CODES)

General

This appendix describes the possible self check error codes for the MTP700 Portable Radios.

Self Check Error Codes

Table D-1 is the possible self check error (non fatal) codes for the MTP700 Portable Radios. No corrective action is required.

Message	Cause
Error00001	A non-fatal error was logged during operation
Error00002	CodePlug error log validity error

Table D-1 Self Check Error (Non-Fatal) Codes

Table D-2 is the possible self check fail (fatal) codes for the MTP700 Portable Radios. The radio is inoperatable, the user should return the radio to Depot.

Message	Cause
Fail00100	Old CodePlug Version failure
Fail00200	New CodePlug Version failure
Fail00400	CodePlug Model failure
Fail00800	CodePlug validity error
Fail00801	CP - Unknown block
Fail00802	CP - Unknown Field
Fail00803	CP - Unknown Flag
Fail00804	CP - Unknown format
Fail00805	CP - Invalid pointer
Fail00806	CP - Invalid path

Table D-2 Self Check Fail (Fatal) Codes

Message	Cause
Fail00807	CP - Invalid handler
Fail00808	CP - Invalid length
Fail00809	CP - Invalid index
Fail0080A	CP - Invalid offset
Fail0080B	CP - Invalid header pointer
Fail0080C	CP - Invalid block header
Fail0080D	CP - Initialization failed
Fail0080E	CP - Recovery failed
Fail0080F	CP - Write failure
Fail00810	CP - Corrupted block
Fail00811	CP - Corrupted codeplug
Fail00812	CP - Radio Operation System error
Fail00813	CP - Lower layer error
Fail00814	CP - Too many arguments
Fail00815	CP - Log Overflow
Fail00816	CP - Invalid Checksum
Fail00817	CP - Not initialized
Fail00818	CP - Ambiguous code
Fail00819	CP - Invalid start entry
Fail0081A	CP - Duplicate data
Fail0081B	CP - Invalid version number
Fail01000	Flash checksum error
Fail02000	A fatal error was logged during operation
Fail10000	Handset communication error
FailF4000	Ergo pre-selftest codeplug error
FailF8000	Ergo pre-selftest invalid device error

Table D-2 Self Check Fail (Fatal) Codes